Arlington Conservation Commission

Date: Thursday, December 1, 2022
Time: 7:00 PM
Location: Conducted by Remote Participation

Pursuant to State Legislation suspending certain provisions of the Open Meeting Law, G. L. c. 30A, § 20 relating to the COVID-19 emergency, the December 1, 2022, public meeting of the Arlington Conservation Commission shall be physically closed to the public to avoid group congregation. The meeting shall instead be held virtually using Zoom. Please register in advance for this meeting. Reference materials, instructions, and access information for this specific meeting will be available 48 hours prior to the meeting on the Commission's agenda and minutes page.

Agenda

1. Administrative
   a. Approval of November 17, 2022, meeting minutes
2. Updates
   a. Water Bodies Working Group
   b. Park & Recreation Commission Liaison
   c. Tree Committee Liaison
3. Discussion
   a. Certificate of Compliance: Mystic Restoration
   b. 19R Park Avenue
   c.
   d. Arlington Great Meadows Habitat Enhancement Activities
4. Hearings

Notice of Intent: 14-16 Edith Street

Notice of Intent: 14-16 Edith Street
Documents: 14-16 Edith Street NOI Application

This public hearing will consider a Notice of Intent to re-build a 2-family dwelling and associated site appurtenances at 14-16 Edith Street, within Bordering Land Subject to Flooding and the outer portion of the 100-foot Buffer Zone to Bordering Vegetated Wetlands.

Notice of Intent: Mystic Bridge

Notice of Intent: Mystic Bridge

This public hearing will consider a Notice of Intent to reconstruct the Mystic Street Bridge at 0 Lot Mystic Street. Work is proposed within the Riverfront Area, Land Under Water, and Bank to Mill Brook, as well as Bordering Vegetated Wetland, and Land Subject to Flooding (Zone AE).

Notice of Intent: 8 Mystic Bank (Continuation, Applicant requests continuance to December 15, 2022 meeting)

Notice of Intent: 8 Mystic Bank (Continuation, Applicant requests continuance to December 15, 2022 meeting)

This public hearing will consider a Notice of Intent for 8 Mystic Bank to replace decking and add stairs and a retaining wall within Bordering Land Subject to Flooding, and the Buffer Zone and Adjacent Upland Resource Area to the Bank of Lower Mystic Lake. Improvements also include in-kind replacement of existing deck materials and in-kind replacement of granite steps leading to the existing dock.

Request for Determination of Applicability: 106-108 Varnum Street

Request for Determination of Applicability: 106-108 Varnum Street

This public hearing will consider a Request for Determination of Applicability to pave a parking area in the rear of 106-108 Varnum Street within Bordering Land Subject to Flooding (Zone AE).

Town of Arlington, Massachusetts

Notice of Intent: 14-16 Edith Street

Summary:
Notice of Intent: 14-16 Edith Street
Documents: 14-16 Edith Street NOI Application

This public hearing will consider a Notice of Intent to re-build a 2-family dwelling and associated site appurtenances at 14-16 Edith Street, within Bordering Land Subject to Flooding and the outer portion of the 100-foot Buffer Zone to Bordering Vegetated Wetlands.

ATTACHMENTS:

	Type	File Name	Description
🗋	Reference Material	NOI_Application_-_14-16_Edith_Street.pdf	NOI Application - 14-16 Edith Street

Notice of Intent Application

November 16, 2022

Subject Property
14-16 Edith Street
Parcel ID: 14-2-4
Arlington, Massachusetts

Applicant and Property Owner
Edith Street Holdings LLC
Stephan Bilharz, Contact
377 Somerville Avenue
Somerville, MA 02143

LEC Environmental Consultants, Inc.
380 Lowell Street
Suite 101
Wakefield, MA 01880
781-245-2500

www.lecenvironmental.com

November 16, 2022

Hand Delivery

Arlington Conservation Commission
Arlington Town Hall Annex
730 Massachusetts Avenue
Arlington, MA 02476

Re: Notice of Intent Application
14-16 Edith Street
Parcel ID: 14-2-4
Arlington, Massachusetts

[LEC File #: ESHLLC\22-281.02]

Dear Members of the Conservation Commission:

On behalf of the Applicant and Property Owner, Edith Street Holdings LLC (Stephan Bilharz, Contact), LEC Environmental Consultants, Inc., (LEC) is filing the enclosed Notice of Intent (NOI) Application with the Arlington Conservation Commission to raze and rebuild a two-family dwelling and associated site appurtenances at 14-16 Edith Street in Arlington, Massachusetts. The property and the proposed activities are located within Bordering Land Subject to Flooding (BLSF) and within the outer portion of the 100-foot Buffer Zone to Bordering Vegetated Wetlands (BVW). The Applicant proposes to implement erosion controls to minimize the potential for impacts to the resource areas during construction, and provide stormwater management, compensatory flood storage, and implement a native planting plan to improve existing site conditions.

LEC was retained to identify Wetland Resource Areas protectable under the *Massachusetts Wetlands Protection Act* (M.G.L. c. 131, s. 40, the *Act*), its implementing Regulations (310 CMR 10.00, the *Act Regulations*), the *Town of Arlington Wetlands Protection Bylaw* (Article 8, the *Bylaw*), and its implementing *Wetlands Protection Regulations* (March 1, 2018, the *Bylaw Regulations*), and to prepare this NOI Application. Gala Simon Associates, Inc., has prepared the enclosed *Drainage Plan* (2 Sheets) dated October 18, 2022 showing the existing and proposed site conditions and construction details (Appendix D); and the *Engineering Drainage Calculations* dated November 4, 2022 (Appendix E). Details of the native landscape plan can be found in the *Proposed Native Restoration Plantings Plan* prepared by Design2, Inc., and dated October 4, 2022 (*Landscape Plan*, Appendix C). Representative site photographs are included in Appendix B.

Enclosed please find two checks made payable to the Town of Arlington in the amounts of Five Hundred Thirty-Seven Dollars and Fifty Cents ($537.50) and Eight Hundred Dollars ($800.00) for the purpose of filing this Application under State and Local guidelines, respectively. Payment to the Commonwealth of Massachusetts in the amount of Five Hundred, Twelve Dollars and Fifty Cents ($512.50) has been processed via eDEP.

Thank you for your consideration of this Application. We look forward to meeting with you at the December 1, 2022 Public Hearing. Should you have any questions, please do not hesitate to contact me in our Wakefield office at 781-245-2500 or at rkirby@lecenvironmental.com.

Sincerely,

LEC Environmental Consultants, Inc.

Richard A. Kirby
Senior Wetland Scientist

cc: DEP, Northeast Region
Edith Street Holdings LLC
Gala Simon Associates, Inc.

rak: projects\22-281.02\NOIReport.doc

Notice of Intent Report

Appendices

Appendix A
Locus Maps
Figure 1: USGS Topographic Quadrangle
Figure 2: FEMA Flood Insurance Rate Map
Figure 3: MassGIS Orthophoto & NHESP Estimated Habitat Map

Appendix B
Site Photographs

Appendix C
Proposed Native Restoration Plantings Plan, dated October 4, 2022, prepared by Design2

Appendix D
Drainage Plan dated October 18, 2022, prepared by Gala Simon Associates, Inc.

Appendix E
Engineering Drainage Calculations, dated November 4, 2022, prepared by Gala Simon Associates, Inc.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

WPA Form 3 – Notice of Intent

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40
Town of Arlington Wetlands Protection Bylaw (Article 8)

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

Arlington
City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

14-16 Edith Street
a. Street Address

Arlington
b. City/Town

02474
c. Zip Code

Latitude and Longitude:

42.401081 N
d. Latitude

--71.146919 W
e. Longitude

14-2
f. Assessors Map/Plat Number

4
g. Parcel /Lot Number

2. Applicant:

Stephan
a. First Name

Bilharz
b. Last Name

Edith Street Holdings LLC
c. Organization

377 Somerville Avenue
d. Street Address

Somerville
e. City/Town

MA
f. State

02143
g. Zip Code

617-690-9969
h. Phone Number

N/A
i. Fax Number

hello@unionsqcapital.com
j. Email Address

3. Property owner (required if different from applicant): ☐ Check if more than one owner

Same as Applicant
a. First Name

b. Last Name

c. Organization

d. Street Address

e. City/Town

f. State

g. Zip Code

h. Phone Number

i. Fax Number

j. Email address

4. Representative (if any):

Richard
a. First Name

Kirby
b. Last Name

LEC Environmental Consultants, Inc.
c. Company

380 Lowell Street, Suite 101
d. Street Address

Wakefield
e. City/Town

MA
f. State

01880
g. Zip Code

781-245-2500
h. Phone Number

781-245-6677
i. Fax Number

rkirby@lecenvironmental.com
j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

$1,050.00
a. Total Fee Paid

$512.50
b. State Fee Paid

$537.50
c. City/Town Fee Paid

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
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Massachusetts Wetlands Protection Act M.G.L. c. 131, §40
Town of Arlington Wetlands Protection Bylaw (Article 8)

Provided by MassDEP:

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City/Town

A. General Information (continued)

6. General Project Description:

The Applicant proposes to raze and rebuild a 2-family dwelling and associated sit appurtenances at 14-16 Edith Street in Arlington, Massachusetts. Portions of the proposed activities are located within Bordering Land Subject to Flooding (BLSF) and the outer portion of the 100-foot Buffer Zone to BVW. The Applicant proposes to implement erosion controls, provide stormwater management and compensatory flood storage, and implement a native landscape plan to minimize the potential for impacts to the resource areas and improve existing site conditions.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☐ Commercial/Industrial
4. ☐ Dock/Pier
5. ☐ Utilities
6. ☐ Coastal engineering Structure
7. ☐ Agriculture (e.g., cranberries, forestry)
8. ☐ Transportation
9. ☒ Other: Multi-Family Dwelling

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☐ Yes ☒ No — If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

2. Limited Project Type

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR 10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

Southern Middlesex
a. County

N/A
b. Certificate # (if registered land)

80538
c. Book

490
d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☐ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
2. ☒ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

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Bureau of Resource Protection - Wetlands
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Town of Arlington Wetlands Protection Bylaw (Article 8)

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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Bank	1. linear feet	2. linear feet
b. ☐ Bordering Vegetated Wetland	1. square feet	2. square feet
c. ☐ Land Under Waterbodies and Waterways	1. square feet	2. square feet
	3. cubic yards dredged	

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☒ Bordering Land Subject to Flooding	1,366± 1. square feet	3,045± 2. square feet
	2,174± 3. cubic feet of flood storage lost	5948± 4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	1. square feet	
	2. cubic feet of flood storage lost	3. cubic feet replaced
f. ☐ Riverfront Area	1. Name of Waterway (if available) - **specify coastal or inland**	

2. Width of Riverfront Area (check one):

☐ 25 ft. - Designated Densely Developed Areas only

☐ 100 ft. - New agricultural projects only

☐ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: ______ square feet

4. Proposed alteration of the Riverfront Area:

a. total square feet	b. square feet within 100 ft.	c. square feet between 100 ft. and 200 ft.

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☐ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

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Town of Arlington Wetlands Protection Bylaw (Article 8)

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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment

	Size of Proposed Alteration	Proposed Replacement (if any)
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet 2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above 1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4. ☐ Restoration/Enhancement

If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

5. ☐ Project Involves Stream Crossings

a. number of new stream crossings

b. number of replacement stream crossings

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C. Other Applicable Standards and Requirements

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

a. ☐ Yes ☒ No

If yes, include proof of mailing or hand delivery of NOI to:

Natural Heritage and Endangered Species Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

2021
b. Date of map

If *yes*, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

c. Submit Supplemental Information for Endangered Species Review*

1. ☐ Percentage/acreage of property to be altered:

(a) within wetland Resource Area ____________________
percentage/acreage

(b) outside Resource Area ____________________
percentage/acreage

2. ☐ Assessor's Map or right-of-way plan of site

2. ☐ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

(a) ☐ Project description (including description of impacts outside of wetland resource area & buffer zone)

(b) ☐ Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/). Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.

** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.

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C. Other Applicable Standards and Requirements (cont'd)

(c) ☐ MESA filing fee (fee information available at http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_fee_schedule.htm). Make check payable to "Commonwealth of Massachusetts - NHESP" and ***mail to NHESP*** at above address

*Projects altering **10 or more acres** of land, also submit:*

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

(f) OR Check One of the Following

1. ☐ Project is exempt from MESA review. Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, http://www.mass.gov/dfwele/dfw/nhesp/regulatory_review/mesa/mesa_exemptions.htm; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing. ____ a. NHESP Tracking # ____ b. Date submitted to NHESP

3. ☐ Separate MESA review completed. Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?

a. ☒ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: DMF.EnvReview-South@state.ma.us

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: DMF.EnvReview-North@state.ma.us

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
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Town of Arlington Wetlands Protection Bylaw (Article 8)

Provided by MassDEP:

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C. Other Applicable Standards and Requirements (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

a. ☐ Yes ☒ No

If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

b. ACEC

5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?

a. ☐ Yes ☒ No

6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

a. ☐ Yes ☒ No

7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?

a. ☐ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:

1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)

2. ☐ A portion of the site constitutes redevelopment

3. ☐ Proprietary BMPs are included in the Stormwater Management System.

b. ☒ No. Check why the project is exempt:

1. ☐ Single-family house

2. ☐ Emergency road repair

3. ☒ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☒ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)

2. ☒ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.

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Provided by MassDEP:

MassDEP File Number

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Arlington
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D. Additional Information (cont'd)

3. ☒ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☒ List the titles and dates for all plans and other materials submitted with this NOI.

Drainage Plan (2 Sheets) and Engineering Drainage Calculations
a. Plan Title

Gala Simon Associates, Inc.
b. Prepared By

Al Gala
c. Signed and Stamped by

Dated October 18, 2022
d. Final Revision Date

1 inch = 10 feet
e. Scale

Engineering Drainage Calculations prepared by Gala Simon Associates, Inc. — November 4, 2022
Proposed Native Restoration Planting Plan prepared by Design2 — October 4, 2022
f. Additional Plan or Document Title — g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. ☐ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. ☒ Attach NOI Wetland Fee Transmittal Form

9. ☐ Attach Stormwater Report, if needed (required under Bylaw).

E. Fees

1. ☐ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

7006
2. Municipal Check Number

10/18/2022
3. Check date

Submitted electronically via eDEP
4. State Check Number

5. Check date

Edith Street Holdings LLC
6. Payor name on check: First Name

7. Payor name on check: Last Name

Provided by MassDEP:

MassDEP File Number

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F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

(Edith Street Holdings, LLC by Stephan Bilharz, manager) — 10/18/2022

1. Signature of Applicant — 2. Date

3. Signature of Property Owner (if different) — 4. Date

10/18/2022

5. Signature of Representative (if any) — 6. Date

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:
One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:
If the applicant has checked the "yes" box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40
Town of Arlington Wetlands Protection Bylaw (Article 8)

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Applicant Information

1. Location of Project:

14-16 Edith Street	Arlington
a. Street Address	b. City/Town
Submitted electronically via eDEP	$512.50
c. Check number	d. Fee amount

2. Applicant Mailing Address:

Stephan		Bilharz	
a. First Name		b. Last Name	
Edith Street Holdings LLC			
c. Organization			
377 Somerville Avenue			
d. Mailing Address			
Somerville		MA	02143
e. City/Town		f. State	g. Zip Code
617-690-9969	N/A	hello@unionsqcapital.com	
h. Phone Number	i. Fax Number	j. Email Address	

3. Property Owner (if different):

Same as Applicant			
a. First Name		b. Last Name	
c. Organization			
d. Mailing Address			
e. City/Town		f. State	g. Zip Code
h. Phone Number	i. Fax Number	j. Email Address	

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

B. Fees

Fee should be calculated using the following process & worksheet. ***Please see Instructions before filling out worksheet.***

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
Cat 3b.) Condo/Apartment Building	1	$1,050.00	$1,050.00

Step 5/Total Project Fee: $1,050.00

Step 6/Fee Payments:

Total Project Fee: $1,050.00
a. Total Fee from Step 5

State share of filing Fee: $512.50
b. 1/2 Total Fee **less $**12.50

City/Town share of filling Fee: $537.50
c. 1/2 Total Fee **plus** $12.50

C. Submittal Requirements

a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

TOWN OF ARLINGTON

730 Massachusetts Ave.
Arlington, MA 02476
781-316-3012

ARLINGTON CONSERVATION COMMISSION

Bylaw Filing Fees and Transmittal Form

Rules:
1.Fees are payable at the time of filing the application and are non-refundable.
2.Fees shall be calculated per schedule below.
3.Town, County, State, and Federal Projects are exempt from fees.
4.These fees are in addition to the fees paid under M.G.L. Ch. 131, s.40 (ACT).

Fee Schedule (ACC approved 1/8/15):

$	No./Area	Category
		(R1) RDA- $150 local fee, no state fee
		(N1) Minor Project - $200 (house addition, tennis court, swimming pool, utility work, work in/on/or affecting any body of water, wetland or floodplain).
		(N2) Single Family Dwelling - $600
$800.00	2 Units in Floodplain	**(N3) Multiple Dwelling Structures** - $600 + $100 per unit all or part of which lies within 100 feet of wetlands or within land subject to flooding.
		(N4) Commercial, Industrial, and Institutional Projects - $800 + 50¢/s.f. wetland disturbed; 2¢/s.f. land subject to flooding or buffer zone disturbed.
		(N5) Subdivisions - $600 + $4/l.f. feet of roadway sideline within 100 ft. of wetlands or within land subject to flooding.
		(N6) Other Fees - copies, printouts; per public records law
		(N7) Minor Project Change - $50
		(N8) Work on Docks, Piers, Revetments, Dikes, etc - $4 per linear foot
		(N9) Resource Boundary Delineation (ANRAD) - $1 per linear foot
		(N10) Certificate of Compliance (COC or PCOC) - No charge if before expiration of Order, $200 if after that date.
		(N11) Amendments - $300 or 50% of original local filing fee, whichever is less.
		(N12) Extensions -
		a. Single family dwelling or minor project - $100.
		b. Other - $150.
		(N13) Consultant Fee -per estimate from consultant
$800.00	**TOTAL**	

Note: Submit this form along with the forms submitted for the ACT - the "Wetlands Filing Fee Calculations Worksheet," and the "Notice of Intent Fee Transmittal Form."

AFFIDAVIT OF SERVICE

Under the
Massachusetts Wetlands Protection Act (M.G.L. c. 131, s. 40),
its implementing *Regulations* (310 CMR 10.00),
and the
Town of Arlington Wetlands Protection Bylaw

I, Sharon A. Sullivan, on behalf of Edith Street Holdings LLC, hereby certify under the pains and penalties of perjury that on November 17, 2022 I gave notification to abutters in compliance with the *Massachusetts Wetlands Protection Act* (M.G.L. c. 131, s. 40), its implementing *Regulations* (310 CMR 10.00), and the *Town of Arlington Wetlands Protection Bylaw* in connection with the following matter:

> A Notice of Intent Application filed under the *Town of Arlington Wetlands Protection Bylaw* by LEC Environmental Consultants, Inc. on behalf of the Applicant, Edith Street Holdings LLC, with the Town of Arlington Conservation Commission on November 17, 2022 for property located at 14-16 Edith Street (Assessor's Parcel ID: 14-2-4) in Arlington, Massachusetts.

The form of notification, and a list of the abutters to whom it was given and their addresses, are attached to this Affidavit of Service.

Sharon A. Sullivan — 11/17/2022

Sharon A. Sullivan — Date
Permitting Technician

LEC

WETLANDS WILDLIFE WATERWAYS

November 17, 2022

CERTIFIED MAIL

«Name»
«Name2»
«Address»
«City», «State» «Zip»

Re: Notice of Intent Application
14-16 Edith Street
Assessor's Parcel ID: 14-2-4
Arlington, Massachusetts

[LEC File #: EHHLLC\22-281.02]

Dear Abutter:

On behalf of the Applicant, Edith Street Holdings LLC, LEC Environmental Consultants, Inc. (LEC) has filed a Notice of Intent Application with the Arlington Conservation Commission to raze and rebuild a two-family dwelling and associated site appurtenances at 14-16 Edith Street in Arlington. Portions of the proposed activities are located within the Bordering Land Subject to Flooding and the outer portion of the 100-foot Buffer Zone to Bordering Vegetated Wetlands, as jurisdictional under the *Massachusetts Wetlands Protection Act* (the *Act*, M.G.L. c. 131, s. 40) and its implementing *Regulations* (the *Act Regulations*, 310 CMR 10.00), and the *Town of Arlington Wetlands Protection Bylaw* (Article 8, the *Bylaw*) and its *Regulations Pursuant to the Town of Arlington Regulations for Wetlands Protection* (the *Bylaw Regulations*).

The Notice of Intent Application and accompanying plans are available for review by contacting the Arlington Conservation Commission. The remote Public Hearing will be held on December 1, 2022 beginning at 7:30 p.m., in accordance with the provisions of the *Act*, *Regulations*, *Bylaw*, and *Bylaw Regulations*. Further information regarding this application will be published at least five (5) days in advance in *The Arlington Advocate*. Notice of the Public Hearing will also be posted at the Arlington Town Hall at least 48 hours in advance. Please check the Town's website and the Board/Committee's page for any updated information on the meeting.

Please do not hesitate to review the materials and/or attend the public hearing should you have questions or concerns about the proposed project.

Sincerely,

LEC Environmental Consultants, Inc.

Richard A. Kirby
Senior Wetland Scientist

Notification to Abutters Under the

Massachusetts Wetlands Protection Act

and the

Town of Arlington Wetlands Protection Bylaw

In accordance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40 and the Town of Arlington Wetlands Protection Bylaw, you are hereby notified of the following:

A. The name of the Applicant is Edith Street Holdings LLC, 377 Somerville Avenue, Somerville, Massachusetts.

B. The Applicant has filed a Notice of Intent Application with the Conservation Commission for the municipality of Arlington, Massachusetts seeking permission to remove, fill, dredge or alter an Area Subject to Protection under Wetlands Protection Act (General Laws Chapter 131, Section 40) and the Town of Arlington Wetlands Protection Bylaw.

C. The activity is proposed on a lot located at 14-16 Edith Street (Assessor's Parcel ID: 14-2-4), Arlington, Massachusetts.

D. Copies of the Notice of Intent Application may be examined by contacting the Arlington Conservation Commission at (781) 316-3012.

   For more information, call: LEC Environmental Consultants, Inc. (the applicant's representative) at (781) 245-2500.

E. Copies of the Notice of Intent Application may be obtained from LEC Environmental Consultants, Inc. (the applicant's representative) by calling (781) 245-2500 between the hours of 8:00 a.m. and 5:00 p.m., Monday through Friday. A fee may be charged for each copy requested.

F. Information regarding the public hearing may be obtained from the Arlington Conservation Commission (the regulatory agency) by calling (781) 316-3012.

NOTE: Notice of the Public Hearing, including its date, time, and place, will be published at least five (5) days in advance in The Arlington Advocate.

NOTE: Notice of the public hearing will also be posted at the Arlington Town Hall not less than 48 hours in advance.

NOTE: You also may contact the nearest Department of Environmental Protection Regional Office for more information about this application or the Wetlands Protection Act. To contact DEP, call:

Northeast Region: 978-694-3200

Office of the
Board of Assessors
Robbins Memorial Town Hall
Arlington, MA 02476
(781) 316-3050
Assessors@town.arlington.ma.us

Abutters List
Date: August 31, 2022

Subject Property Address: 14-16 EDITH ST Arlington, MA
Subject Property ID: 14-2-4

Search Distance: 100 Feet

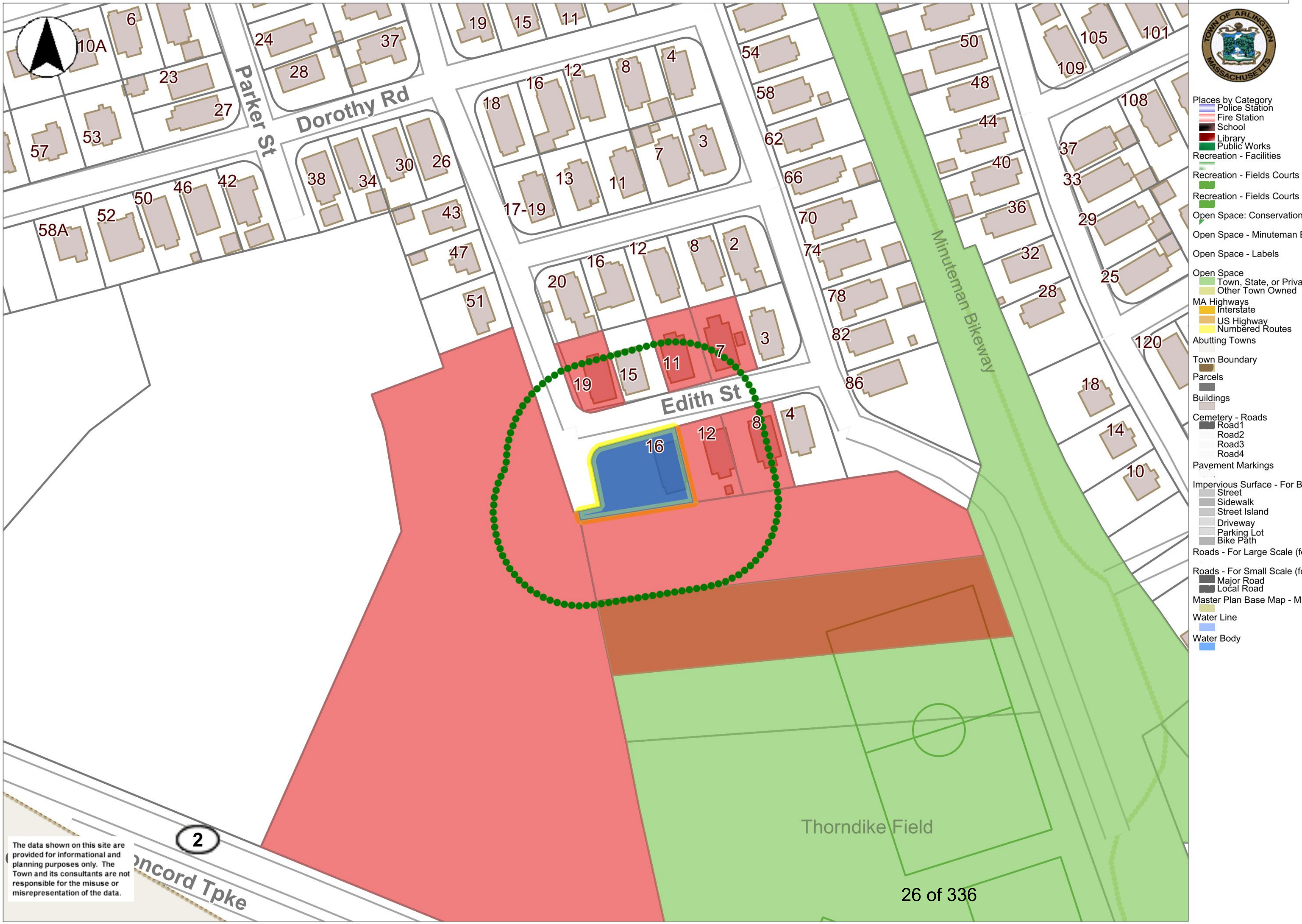
The Board of Assessors certifies the names and addresses of requested parties in interest, all abutters within 100 feet of the property lines, of subject property.

BOARD OF ASSESSORS
TOWN HALL
ARLINGTON, MA 02476

Board of Assessors

ABUTTERS LIST
Date: August 31, 2022
Subject Property Location: 14-16 EDITH ST Arlington, MA
Subject Property ID: 14-2-4
Search Distance: 100 Feet

				Mailing Address			
Parcel ID	**Property Location**	**Owner 1**	**Owner 2**	**Street Address**	**City/Town**	**State**	**Zip**
13-6-2	5-7 EDITH ST	LEITERMANN RICHARD E/KATHLEEN		5 EDITH ST	ARLINGTON	MA	02474
13-6-5	17-19 EDITH ST	PLUCK FRANK &	COOGAN BRID	17 EDITH STREET	ARLINGTON	MA	02474
14-2-2	6-8 EDITH ST	OSMER JOHN E & ISIDORA	LIFE ESTATE	6 EDITH ST	ARLINGTON	MA	02474
14-2-4	**14-16 EDITH ST**	**EDITH STREET HOLDINGS LLC**		**377 SOMERVILLE AVE**	**SOMERVILLE**	**MA**	**02143**
14-2-5	0-LOT THORNDIKE ST EXT	ARLINGTON LAND REALTY LLC	c/o MUGAR ENTERPRISES INC	222 BERKELEY ST. SUITE 1450	BOSTON	MA	02116
14-2-6	0-LOT THORNDIKE ST EXT	TOWN OF ARLINGTON PARK		730 MASS AVE	ARLINGTON	MA	02476
14-2-8	0-LOT CONCORD TPKE	ARLINGTON LAND REALTY LLC	c/o MUGAR ENTERPRISES INC	222 BERKELEY ST. SUITE 1450	BOSTON	MA	02116
14.A-2-10	10-12 EDITH ST UNIT 10	ROONEY ELIZABETH M	HAKIM GEORGE MICHAEL	10 EDITH ST	ARLINGTON	MA	02474
14.A-2-12	10-12 EDITH ST UNIT 12	PANG RUILIN	HE JING	4967 DONALD AVE	RICHMOND HEIGHTS	OH	44143-2801
13.A-6-9	9-11 EDITH ST UNIT 9	REID HEATHER G		9 EDITH ST	ARLINGTON	MA	02474
13.A-6-11	9-11 EDITH ST UNIT 11	LAINO ANDRESSA SODRE C		11 EDITH ST	ARLINGTON	MA	02474
13.A-6-13	13-15 EDITH ST UNIT 13	STARR EMMA L		13 EDITH ST	ARLINGTON	MA	02474
13.A-6-15	13-15 EDITH ST UNIT 15	HE BINGQING		15 EDITH ST	ARLINGTON	MA	02474



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Printed on 08/31/2022 at 08:50 AM

LEC

Notice of Intent Application

14-16 Edith Street

Arlington, Massachusetts

November 16, 2022

1. Introduction

On behalf of the Applicant and Property Owner, Edith Street Holdings LLC (Stephan Bilharz, Contact), LEC Environmental Consultants, Inc., (LEC) is filing the enclosed Notice of Intent (NOI) Application with the Arlington Conservation Commission under the *Massachusetts Wetlands Protection Act* (M.G.L. c. 131, s. 40, the *Act*), its implementing Regulations (310 CMR 10.00, the *Act Regulations*), the *Town of Arlington Wetlands Protection Bylaw* (Article 8, the *Bylaw*), and its implementing *Wetlands Protection Regulations* (March 1, 2018, the *Bylaw Regulations*). The Applicant is filing this NOI Application to raze and rebuild a two-family dwelling and conduct other site work within Bordering Land Subject to Flooding (BLSF) and the outer portion of the 100-foot Buffer Zone to Bordering Vegetated Wetlands (BVW).

As part of this filing, the Applicant proposes to implement mitigation measures, including erosion controls to protect adjacent resource areas and properties during construction, and stormwater management, compensatory flood storage, and a native planting plan to improve existing site conditions. Gala Simon Associates, Inc., has prepared the enclosed *Drainage Plan* (2 Sheets) dated October 18, 2022 showing the existing and proposed site conditions and construction details (*Site Plan,* Appendix D); and the *Engineering Drainage Calculations* dated November 4, 2022 (Appendix E). Details of the native landscape can be found in the *Proposed Native Restoration Plantings Plan* prepared by Design2, Inc., and dated October 4, 2022 (*Landscape Plan,* Appendix C). Representative site photographs are included in Appendix B.

2. General Site Description

The 8,401± square foot property is located in the East Arlington neighborhood of Arlington, Massachusetts, north of Thorndike Field and south of Lake Street. More specifically, the property is located on the south side of Edith Street, southeast of the Burch Street intersection. Residential development associated with Edith Street and Burch Street occurs to the north and east of the site, while undeveloped land occurs to the south and west.

The property contains a 2.5-story, two-family dwelling with a paved driveway extending from Edith Street. A concrete walkway also extends from Edith Street, providing access to the front entrance and along the eastern side of the dwelling. A wooden deck occurs off the southwestern corner of the structure, and concrete patios occur at the southwestern

and southeastern property corners. A 6-foot high wooden privacy fence occurs along portions of the site periphery. The dwelling and associated appurtenances are surrounded by lawn and landscaped areas. Landscape plants include Canada yew (*Taxus canadensis*), rhododendron and azalea (*Rhododendron* spp.), spirea (*Spirea* sp.), Alberta spruce (*Picea glauca*), and privet (*Ligustrum* sp.). Topography gently descends southerly from Edith Street toward the backyard, with an elevation grade of roughly 2.5 feet.

Forested uplands occur to the south and west of the property. The canopy contains patches of Norway maple (*Acer platanoides*), with scattered individuals of black cherry (*Prunus serotina*), red maple (*Acer rubrum*), box elder (*Acer negundo*), and paper birch (*Betula papyrifera*). The understory contains saplings from the canopy, along with sapling oak (*Quercus* sp.), sapling ash (*Fraxinus* sp.), crab apple (*Malus* sp.), common buckthorn (*Rhamnus cathartica*), and Oriental bittersweet (*Celastrus scandens*). Vegetation within the groundcover includes patches of garlic mustard (*Alliaria petiolata*), Virginia creeper (*Parthenocissus quinquefolia*), and celandine (*Chelidonium majus*).

Using a hand-held, Dutch-style soil auger, LEC inspected soil conditions within uplands adjacent to the BVW boundary and observed 16+ inches of loamy sand historic fill material (C horizon) containing brick fragments and other man-made materials. The soil matrix color ranges from 10YR 2/2 to 10YR 3/3. No redoximorphic features or other indicators of hydrology were observed.

2.1 Natural Heritage and Endangered Species Program Designation

According to the 15th Edition of the *Massachusetts Natural Heritage Atlas* (effective August 1, 2021) published by the Natural Heritage & Endangered Species Program (NHESP), no areas of Estimated Habitats of Rare Wildlife or Priority Habitat of Rare Species, or Potential or Certified Vernal Pools exist on the site (Appendix A, Figure 3).

3. Wetland Resource Areas

LEC conducted a site evaluation on June 23, 2022 to identify and characterize existing protectable Wetland Resource Areas located on or immediately adjacent to the site, and determined that the entire site is located within BLSF, and an off-site BVW places the 100-foot Buffer Zone onto the southeastern property corner.

3.1 Bordering Land Subject to Flooding

According to 310 CMR 10.57 (2) (a) 1, *Bordering Land Subject to Flooding (BLSF) is an area with low, flat topography adjacent to and inundated by flood waters rising from*

creeks, rivers, streams, ponds or lakes. It extends from the banks of these waterways and water bodies; where a bordering vegetated wetland occurs, it extends from said wetland.

According to Section 4 B. (38), *LAND SUBJECT TO FLOODING OR INUNDATION – shall mean the land within the estimated maximum lateral extent of flood water which will theoretically result from the statistical 100-year frequency storm; said boundary shall be that determined by reference to the most recently available flood profile data prepared for Arlington within which the work is proposed under the National Flood Insurance Program "(NFIP)"…*

According to the June 4, 2010 *Federal Emergency Management Agency National Flood Hazard Layer FIRMette* (Map No: 25017C0419E), the entire property is located within Zone AE: – *Special Flood Hazard Areas (SFHAs) subject to Inundation by the 1% Annual chance Flood; Base Flood Elevations determined* (Appendix A, Figure 2). According to the *FIRMette*, the Zone AE occurs at the Elevation 6.8 contour (Datum: NAVD 88, herein referred to as the "floodplain elevation"). Therefore, the entire property is jurisdictional as BLSF. No portion of the site is located within the Floodway.

3.2 Bordering Vegetated Wetlands

BVW is defined at 310 CMR 10.55(2) as: *freshwater wetlands which border on creeks, rivers, streams, ponds, and lakes…Bordering Vegetated Wetlands are areas where the soils are saturated and/or inundated such that they support a predominance of wetland indicator plants…The boundary of Bordering Vegetated Wetlands is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated conditions exist.*

According to the *Bylaw Regulations* [Section 21 B. (1) and (2)], Vegetated Wetlands *are freshwater wetlands, including both bordering vegetated wetlands (i.e., bordering on freshwater bodies such as on creeks, rivers, streams, ponds and lakes), and isolated vegetated wetlands which do not border on any permanent water body. The types of freshwater wetlands are wet meadows, marshes, swamps, bogs and vernal pools. Vegetated Wetlands are areas where soils are saturated and/or inundated such that they support a predominance of wetland indicator plants. The ground water and surface water hydrological regime, soils and the vegetational community which occur in each type of freshwater wetlands, including both bordering and isolated vegetated wetlands, are defined under the Bylaw based on G.L. c. 131, § 40. (2) The boundary of Vegetated Wetland, whether Bordering or Isolated, is the line within which 50% or more of the vegetational community consists of wetland indicator plants and saturated or inundated*

conditions exist. Wetland indicator plants shall include but not necessarily be limited to those plant species identified in the Act.

A narrow band of forested wetlands bordering a drainage ditch (intermittent stream) occur south of the property on land owned by the Town of Arlington. The canopy contains patches of Norway maple and red maple with scattered inclusions of ash. The understory contains patches of box elder and false indigo bush (*Amorpha fruticosa*), and entanglements of grape (*Vitis* sp.). The groundcover contains poison ivy (*Toxicodendron radicans*).

LEC inspected soils within the BVW using a hand-held, Dutch-style auger and observed a loamy sand topsoil (A horizon) with a soil matrix color of 10YR 2/1. Redoximorphic concentrations were observed within 12 inches of the soil surface. This soil profile is considered a hydric soil in accordance with the *Field Indicators Guide for Identifying Hydric Soils in New England* (2019).

4. Proposed Construction Activities

The Applicant proposes to demolish the existing 2-family dwelling and deck, and remove the existing driveway, walkway, and concrete patios; and construct a new 2-family dwelling with shared pervious paver driveway and wooden steps and landings providing access to the dwelling units.

Under existing conditions, the dwelling and driveway/parking area are situated well within the floodplain roughly between elevations 4 and 6, displacing the floodplain, exposing the dwelling to floodwater during flood events and impeding floodwater flows. The proposed structure is elevated 10± feet above the floodplain elevation, except for two utility rooms. These utility rooms will contain water heaters, tanks, etc., and provide an insulated space for water and sewer lines to enter the living space above. The utility infrastructure will be set above the floodplain elevation.

These measures provide a significant improvement to the site's floodplain function and value and to climate resiliency compared to existing conditions, and the Applicant maximizes the compensatory flood storage associated with the site (as further discussed below in Section 5.3), exceeding the 2:1 compensatory flood storage requirement in the *Bylaw Regulations.*

The proposed structure will be elevated above the ground surface and supported by twenty (20) 14" x 14" building columns. Specifically, the living space will occur at

roughly elevation 16.5, or roughly 10 feet above the floodplain elevation of 6.8. Two (2) utility closets at ground level are needed to house the sewer and water infrastructure extending from Edith Street. These 5.1' x 9.7' structures are located just off (and accessed from) the rear corners of the parking area. Retaining walls are proposed to elevate the floors of the utility closets above the surrounding land.

The concrete parking area is proposed beneath the dwelling and will occur roughly at elevation 6. Retaining walls measuring up to 1.5 feet in height are proposed on either side of the parking area to maximize flood storage elsewhere beneath the structure, which will be covered with gravel.

While the proposed structure will be larger than the existing structure, impervious area associated with the site only increases by 418± square feet (from 2,792± to 3,210± square feet). This is achieved by eliminating existing impervious areas (walkways, patios, and paved driveway), and proposing a pervious paver driveway. Stormwater management exceeding Arlington's standards is proposed as further discussed below in Section 6.2.

Site grading is proposed to provide compensatory flood storage within the surrounding lawn area. Specifically, grading is proposed to lower existing elevations within the lawn area between elevations 3.5 and 6, and removing the existing structure also provides compensatory flood storage as discussed further below in Section 5.3.

5. Mitigation Measures

The Applicant intends to implement erosion controls to protect adjacent properties and wetland resource areas during construction, provide stormwater management in accordance with Arlington town standards, provide >2:1 compensatory flood storage to improve the flood storage capacity on the site; and implement a native landscaping plan. These mitigating measures are intended to meet or exceed the regulatory requirements enumerated in the *Act Regulations* and the *Bylaw Regulations*, and to promote climate resiliency in accordance with the *Bylaw Regulations.* A description of each of the mitigating measures is provided below.

5.1 Erosion and Sedimentation Control

The Applicant proposes to implement an erosion control program to protect the adjacent Wetland Resource Areas from sedimentation during construction activities. The plan for the control of potential impacts to the adjacent Wetland Resource Areas is based on DEP guidelines and will be comprised of staked compost filter tubes along the eastern,

western, and southern Limit-of-Work line. All erosion control measures will remain in place until disturbed areas are stabilized by vegetation. The location of the proposed erosion controls and a detail are shown on the *Site Plan* (Appendix D).

5.2 Stormwater Management

Under existing conditions, no stormwater management occurs on the property for impervious areas. The Applicant proposes a decrease in the peak rates and volumes of stormwater run-off by including a pervious paver driveway in the design. Details of the porous paver driveway are provided on the *Site Plans* (Appendix D). The system has been designed using the Extreme Precipitation Tables published by the Northeast Regional Climate Center, and exceeds the town of Arlington requirements by reducing peak rates and volumes compared to existing conditions for the 2, 10, 25, and 100-year statistical storm events. An Operation & Maintenance Plan is included in the *Engineering Drainage Calculations* (Appendix E).

Summary of Stormwater Runoff and Volume

Storm Event	*Existing Conditions Peak*		*Proposed Conditions Peak*		*Δ*	
	Runoff (cfs)	*Volume (af)*	*Runoff (cfs)*	*Volume (af)*	*Runoff (cfs)*	*Volume (af)*
2-Year (3.23 in)	0.05	0.006	0.04	0.006	-0.01	0
10-Year (4.90 in)	0.23	0.019	0.22	0.018	-0.01	-0.001
25-Year (6.20 in)	0.41	0.032	0.39	0.030	-0.02	-0.002
100-Year (8.89 in)	0.86	0.063	0.81	0.059	-0.05	-0.004

5.3 Compensatory Flood Storage

Project Engineer Al Gala of Gala Simon Associates, Inc., has designed the project to provide compensatory flood storage to the maximum extent practicable to mitigate for the proposed floodplain displacement resulting from the proposed project, as provided on the Flood Fill/Comp. Calculations section of the *Site Plan* (Sheet 2). Work is proposed within BLSF between elevations 3.5 and 7, including: 1) the two utility closets proposed at ground level at the northeastern and northwestern dwelling corners; 2) elevating the parking area within the 100-year floodplain; and 3) the 14" square building column required to support the structure above the floodplain.

Compensatory flood storage is proposed between elevations 3.5 and 7 to mitigate for the above displacement by: 1) removing the existing structure; and 2) excavating land within the adjacent lawn areas.

Accordingly, the project results in ratios of compensatory flood storage to floodplain fill as follows:

Elevations 3.5-4: 2.15:1

Elevations 4-5: 2.21:1

Elevations 5-6: 2.08:1

Elevations 6-7: 2.86:1

Calculating all of the proposed fill within the floodplain and all of the proposed compensatory flood storage results in a 2.29:1 ratio of compensatory flood storage to fill within the floodplain.

5.4 The Planting of Native Sapling Trees and Shrubs

The Applicant proposes to implement the *Landscape Plan* (Appendix C), which includes native sapling trees, shrubs, and groundcover plantings all derived from the *Recommended Native Plant Materials List* published by the Arlington Conservation Commission in 2014. The intent of this *Landscape Plan* is to improve the function and value of the BLSF compared to existing conditions by establishing native planting beds around the perimeter of the property. The *Landscape Plan* includes 14 native sapling trees and 65 native shrubs with native perennial beds throughout. All planting areas will be stabilized with leaf compost. Please refer to the *Landscape Plan* for additional details and specifications.

6. Regulatory Performance Standards

The *Act Regulations* and *Bylaw Regulations* provide specific performance standards for work within Bordering Land Subject to Flooding, and the *Bylaw Regulations* provide additional standards for climate resiliency. Citations of the pertinent performance standards are provided below, along with a description of how the project meets these standards.

6.1 Bordering Land Subject to Flooding Performance Standards

The *Act Regulations* at 310 CMR 10.57 (4) state that *work within BLSF shall conform to the following criteria*:

(a) *Bordering Land Subject to Flooding*

(1) *Compensatory storage shall be provided for all flood storage volume that will be lost as a result of the proposed work.*

The project will result in an increase of flood storage volume compared to existing conditions for each incremental elevation where work is proposed, between elevations 3.5 and 7, as depicted on the Flood Fill/Comp. Calculations section of the *Site Plan.*

(2) *Work within BLSF…shall not restrict flows so as to cause an increase in flood stage or velocity.*

Proposed work in the floodplain will not restrict flows or cause an increase in flood storage.

(3) *within BLSF shall not impair its capacity to provide important wildlife habitat functions.*

According to the BLSF Preamble at 310 CMR 10.57 (1) (a) 3:

Certain portions of Bordering Land Subject to Flooding are also likely to be significant to the protection of wildlife habitat. These include all areas on the ten year floodplain or within 100 feet of the bank or bordering vegetated wetland (whichever is further from the water body or waterway, so long as such area is contained within the 100 year floodplain), and all vernal pool habitat on the 100 year floodplain, except for those portions of which have been so extensively altered by human activity that their important wildlife habitat functions have been effectively eliminated (such "altered" areas include paved and graveled areas, golf courses, cemeteries, playgrounds, landfills, fairgrounds, quarries, gravel pits, buildings, lawns, gardens, roadways (including median strips, areas enclosed within highway interchanges, shoulders, and embankments), railroad tracks (including ballast and embankments), and similar areas lawfully existing on November 1, 1987 and maintained as such since that time).

The portion of land located within BLSF is "altered" and is therefore not significant to the protection of wildlife habitat.

(b) Protection of Rare Wildlife Species

(1) *Notwithstanding the provisions of 310 CMR 10.57(4)(a) or (b), no project may be permitted which will have any adverse effect on specified wildlife habitat sites of rare vertebrate or invertebrate species.*

There are no specified wildlife habitat sites of rare vertebrate or invertebrate species located on the project site; therefore, the proposed project will have no adverse effect on any such sites. Rather, implementing the *Landscape Plan* will

improve wildlife habitat value for the site by providing food and cover resources for birds, insects, and small mammals.

6.2 Bylaw Performance Standards for Work Within the Floodplain

Section 23 D. of the *Bylaw Regulations* states: *The Commission may permit activity on land subject to flooding provided it shall not result in the following:*

(1) Flood damage due to filling which causes lateral displacement of water that would otherwise be confined within said area.

The project has been designed to provide more compensatory flood storage than currently exists, with 2.29:1 compensatory flood storage for each incremental elevation between elevations 3.5 and 7 compared to existing conditions, and will not result in any increased lateral displacement of water.

(2) Adverse effect on public and private water supply or groundwater supply, where said area is underlain by pervious material.

The project will not result in any increase in pollutants that could otherwise potentially result in an adverse effect on public or private water supply or groundwater supply.

(3) An adverse effect on the capacity of said area to prevent pollution of the groundwater, where the area is underlain by pervious material which in turn is covered by a mat of organic peat and muck.

LEC did not observe any such conditions within or near the subject property.

6.3 BLSF Climate Resiliency

The *Bylaw Regulations* (Section 23 D.) also state that *the applicant shall take into consideration the impacts of climate change on the activities proposed on land subject to flooding, especially in terms of the compensatory flood storage as a climate change resilience strategy. Any such activity shall provide compensatory flood storage for all flood storage volume that will be lost at each elevation. Compensatory flood storage shall be at a 2:1 ratio, minimum, for each unit volume of flood storage lost at each elevation.*

As described above in Section 5.3 of this NOI Report, Project Engineer Al Gala of Gala Simon Associates, Inc., has designed the project to maximize compensatory flood storage compared to flood storage loss, as provided on the Flood Fill/Comp. Calculations section of the *Site Plan*. The design exceeds the compensatory flood storage requirements in the *Bylaw Regulations* by providing a 2.29:1 ratio of compensatory flood storage.

6.4 General Climate Resiliency

The *Bylaw Regulations* (Section 31) state that *B. The Applicant shall, to the extent practicable and applicable as determined solely by the Commission, integrate considerations of adaptation planning into their project to promote climate change resilience so as to protect and promote resource area values into the future. These considerations are especially important in Land Subject to Flooding (floodplain) and Riverfront Area and other Resource Areas which protect the interest of Flood Control and Storm Damage Prevention, including Adjacent Upland Resource Areas. These Resource Areas may be directly impacted by extreme weather events expected to be more prevalent or more intense due to climate change, in surface runoff of pollutants, and in wildlife habitat due to changes in temperature. The Applicant shall consider the project's adaptation to potential climate change impacts by addressing the following:*

(1) Describe project design considerations to limit storm and flood damage during extended periods of disruption and flooding as might be expected in extreme weather events. See Vegetative Wetlands Section 21, Land Subject to Flooding Section 23, and Adjacent Upland Resource Area Section 25, of these Regulations.

The proposed dwelling has been designed such that all living space is elevated nearly 10 feet above the floodplain elevation. This includes all mechanicals (water heaters, hot water tanks, A/C units, etc.).

(2) Describe project stormwater surface runoff, which may increase due to storm surges and extreme weather events, and how this will be managed / mitigated to prevent pollution (including nutrients from fertilizers, roadway runoff, etc.) from entering the resource area with consideration of eliminating impervious surfaces as feasible. See Stormwater Management Section 33 of these Regulations.

The reduction of the peak rates and volumes of stormwater run-off included in the *Stormwater Report* is based on the Extreme Precipitation Tables published by the Northeast Regional Climate Center, and exceeds Town of Arlington requirements by reducing peak rates and volumes of stormwater run-off for the 2, 10, 25, and 100-year statistical storm events compared to existing conditions. This effort will reduce the rate and volume of stormwater run-off from the property.

(3) Describe project vegetation / planting plans and other measures to improve the resiliency of the wildlife habitat of the resource area to withstand potential temperature and rainfall changes (drought and excess) due to climate change. See Vegetation Removal and Replacement Section 24 of these Regulations.

The Applicant will implement the *Landscape Plan,* which specifies many native plants for the property. This effort will improve wildlife habitat and mitigate sediment and nutrients compared to existing conditions.

(4) Describe measures to protect proposed structures and minimize damage to structures due to the impacts of climate change.

The Applicant proposes a largely elevated structure supported by building columns, such that the first floor living space measures roughly 10 feet above the floodplain elevation. All mechanicals will be located above the 100-year floodplain elevation, either within the utility closets or within the units.

7. Summary

On behalf of the Applicant and Property Owner, Edith Street Holdings LLC, LEC is filing the enclosed NOI Application with the Arlington Conservation Commission to raze and rebuild a two-family dwelling and associated site appurtenances at 14-16 Edith Street. The proposed activities will occur within BLSF, and within the outer portion of the 100-foot Buffer Zone to BVW as jurisdictional under the *Act,* its implementing *Regulations,* and the *Bylaw* and *Bylaw Regulations*.

In an effort to mitigate for the proposed activities, the Applicant proposes to implement mitigation measures, including erosion controls to protect the adjacent properties during construction, compensatory flood storage at a 2.29:1 ratio which exceeds the requirements enumerated in the *Act Regulations* and the *Bylaw Regulations.* Further, the Applicant will implement the enclosed *Landscape Plan,* which includes many native plants intended to improve wildlife habitat and promote climate resiliency. The project, including the proposed mitigating measures, meets or exceeds the performance standards enumerated in the *Act Regulations*, and the *Bylaw Regulations,* and the Applicant requests that the Commission issue an Order of Conditions approving the project as proposed herein.

Arlington Conservation Commission, *Town of Arlington Wetlands Protection Bylaw* (Article 8) Town of Arlington, Massachusetts.

Massachusetts Department of Environmental Protection, Division of Wetlands and Waterways 1995. *Delineating Bordering Vegetated Wetlands Under the Massachusetts Wetlands Protection Act, A Handbook*. 89 pp.

Massachusetts Natural Heritage and Endangered Species Program Atlas of Estimated Habitat of State-listed Rare Wetlands Wildlife, Natural Heritage & Endangered Species Program, Massachusetts Division of Fisheries & Wildlife, Route 135, Westborough, MA 01581, www.state.ma.us/dfwele/dfw

Massachusetts Wetlands Protection Act (M.G.L. c. 131, §. 40), www.state.ma.us/dep
Massachusetts Wetlands Protection Act Regulations (310 CMR 10.00), www.state.ma.us/dep

National Flood Insurance Program, Federal Emergency Management Agency Flood Insurance Rate Map (Map Number 25017C0419E), Middlesex County, June 4, 2010.

New England Hydric Soils Technical Committee. 2019, 4th ed., *Field Indicators for Identifying Hydric Soils in New England*, New England Interstate Water Pollution Control Commission, Lowell, MA.

Reed, P.B. 1988. *National List of Plant Species that Occur in Wetlands: 1988 Massachusetts*. U.S. Department of the Interior, Fish and Wildlife Service. NERC-88/18.21

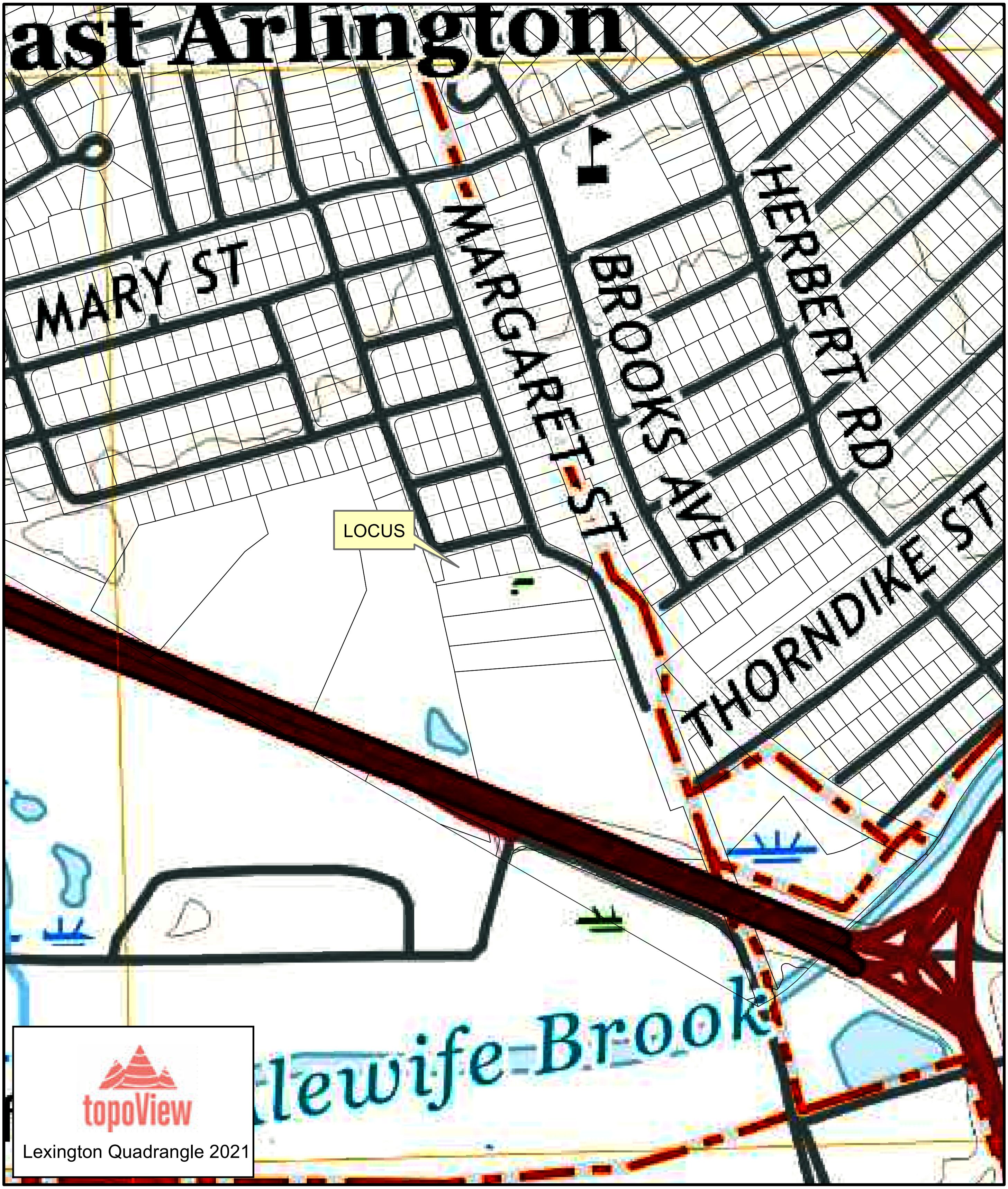
Appendix A

Locus Maps

Figure 1: USGS Topographic Quadrangle

Figure 2: FEMA Flood Insurance Rate Map

Figure 3: MassGIS Orthophoto & NHESP Estimated Habitat Map



LEC

Environmental Consultants, Inc.

Wakefield, MA

781.245.2500

www.lecenvironmental.com

Figure 1: USGS Topographic Map
14-16 Edith Street
Arlington, MA

October 20, 2022

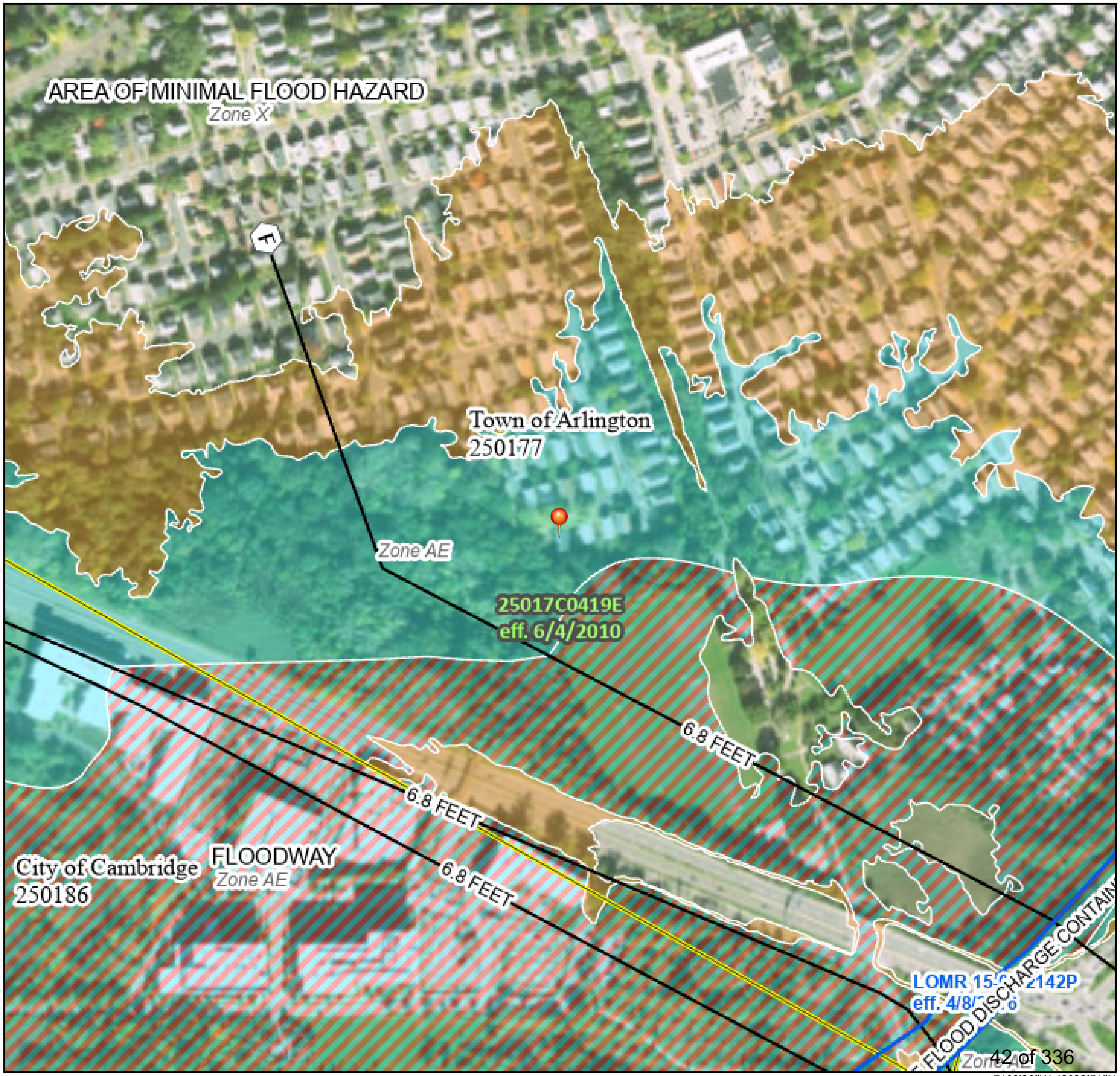
N

0 200 400 Feet

National Flood Hazard Layer FIRMette Figure 2

FEMA

71°9'7"W 42°24'17"N



71°8'30"W 42°23'51"N

Feet 1:6,000

0 250 500 1,000 1,500 2,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/18/2022 at 12:01 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

LEC
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Wakefield, MA
781.245.2500
www.lecenvironmental.com

Figure 3: MassGIS Orthophoto & NHESP Map
14-16 Edith Street
Arlington, MA

October 20, 2022

N

0 50 100 Feet

Appendix B

Site Photographs

Southeasterly view of existing 2-family dwelling and driveway

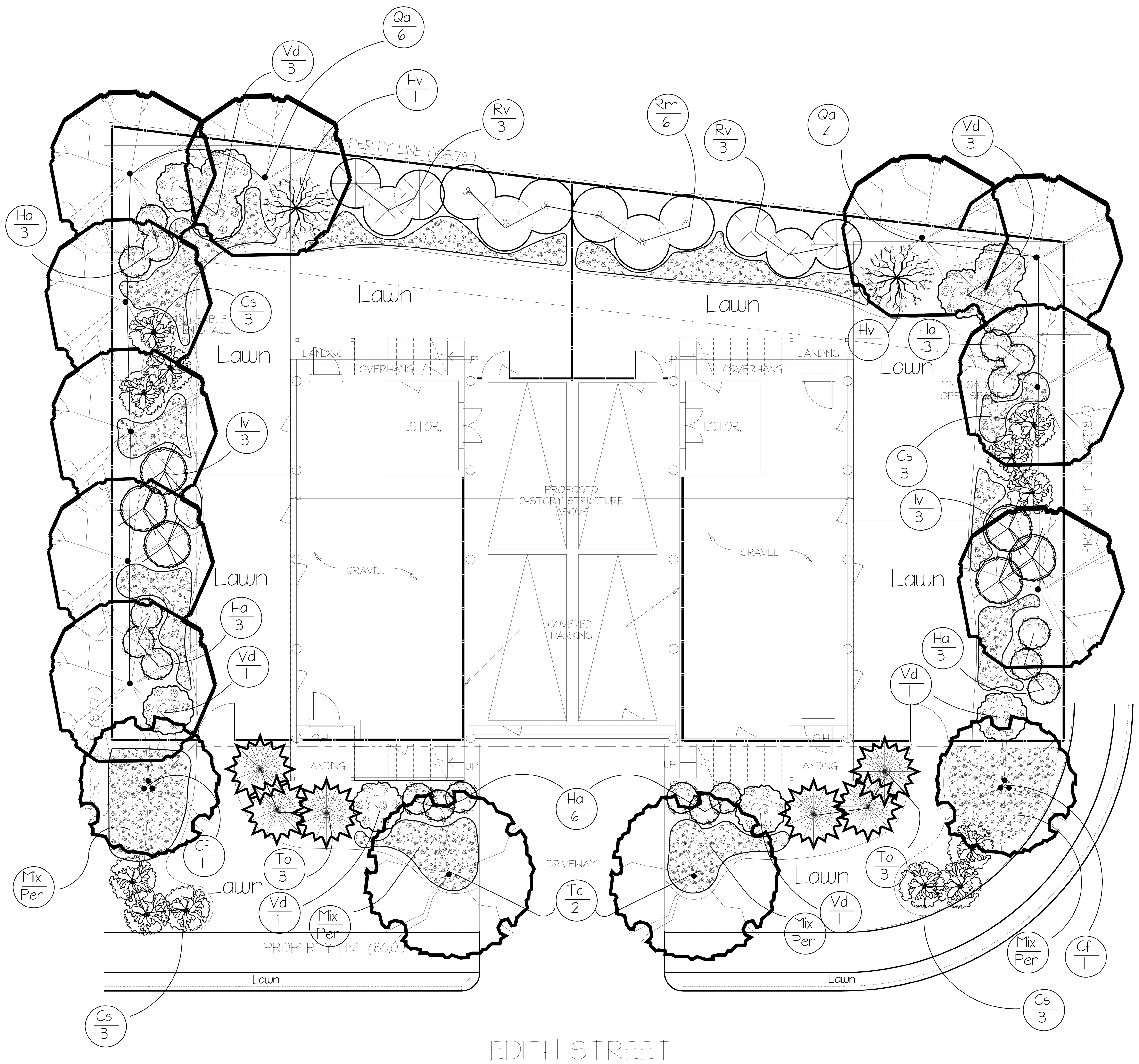
Northwesterly view of 2-family dwelling and paved patio in southwestern corner of property

Southeasterly view of BVW and BVW flags

Debris within wooded uplands south of property

Appendix C

Proposed Native Restoration Plantings Plan, dated October 4, 2022, prepared by Design2



LANDSCAPE PLAN NOTES:

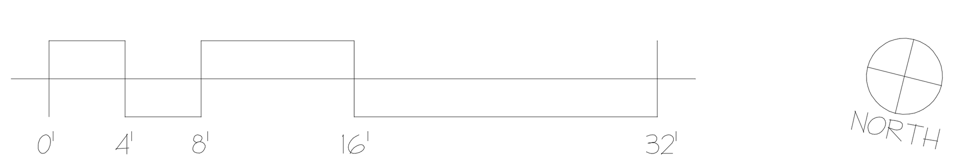
1. THIS PLAN IS FOR INFORMATIONAL & ILLUSTRATIVE PURPOSES ONLY. THE PREPARER OF THIS PLAN MAKES NO CLAIM TO ITS ACCURACY. THIS PLAN SHALL NOT BE USED OR RELIED UPON IN ANY CIRCUMSTANCE. A CERTIFIED LAND SURVEYOR SHALL PROVIDE AN OFFICIAL CERTIFIED PLOT PLAN.

2. SEE EXISTING & PROPOSED SITE PLANS BY OTHERS FOR ADDITIONAL SCOPE, DIMENSIONS, EXISTING CONDITIONS, & PROPOSED CONDITIONS.

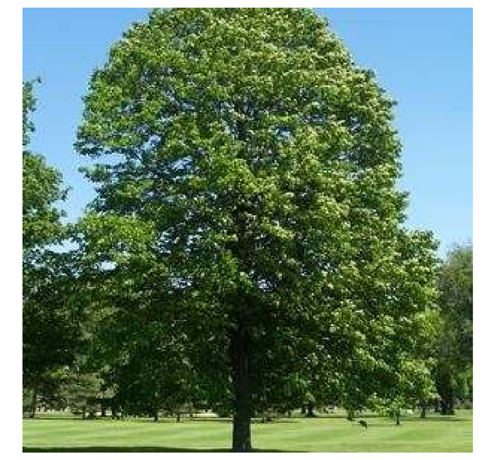
3. 6' TALL VINYL FENCE AT BACK AND SIDES OF PROPERTY. 4' TALL METAL OR VINYL FENCE AT FRONT OF PROPERTY

4. ALL FENCING SHAL MAINTAIN 4 INCHES OF CLEARANCE AT THE BOTTOM OF EACH FENCE PANEL TO ALLOW FOR WILDLIFE MOVEMENT

5. ALL PLANT BEDS TOPPED WITH 2" OF LEAF MULCH
ALL PLANT BED AREAS CONTAIN NATIVE RESTORATION PLANTINGS



Native Restoration Plantings - Trees and Shrubs


Tc - Tilia americana
(2) 2.5-3" cal.


Ha - Clethra alnifolia
(18) 7 gal CN


Vd - Viburnum dentatum
(10) 6-7' B&B


Hv - Hamamelis virginiana
(2) 4-5'


Cf - Cornus florida
(2) 2-2.5" cal


To - Juniperus virginiana
(2.5-3" cal.


Qa - Quercus alba
(10) 2.5-3" cal


Rv - Rhododendron viscosum
(6) 10 gal


Rm - Rhododendron maximum
(6) 5-6'


Cs - Cornus sericea
(12) 5 gal


Iv - Ilex verticillata
(6) 7 gal

Mix Per Mixed Perennials


Lobelia cardinalis


Amsonia tabernaemontana


Penstemon digitalis


Eupatorium maculatum


Aster novae-angliae


Baptisia australis


Lobelia siphilitica


Coreopsis verticillata

ETC...

Developed By:
Sasha Pliyavskiy MALD
617-913-4395
sashap.design2@gmail.com

NORTH

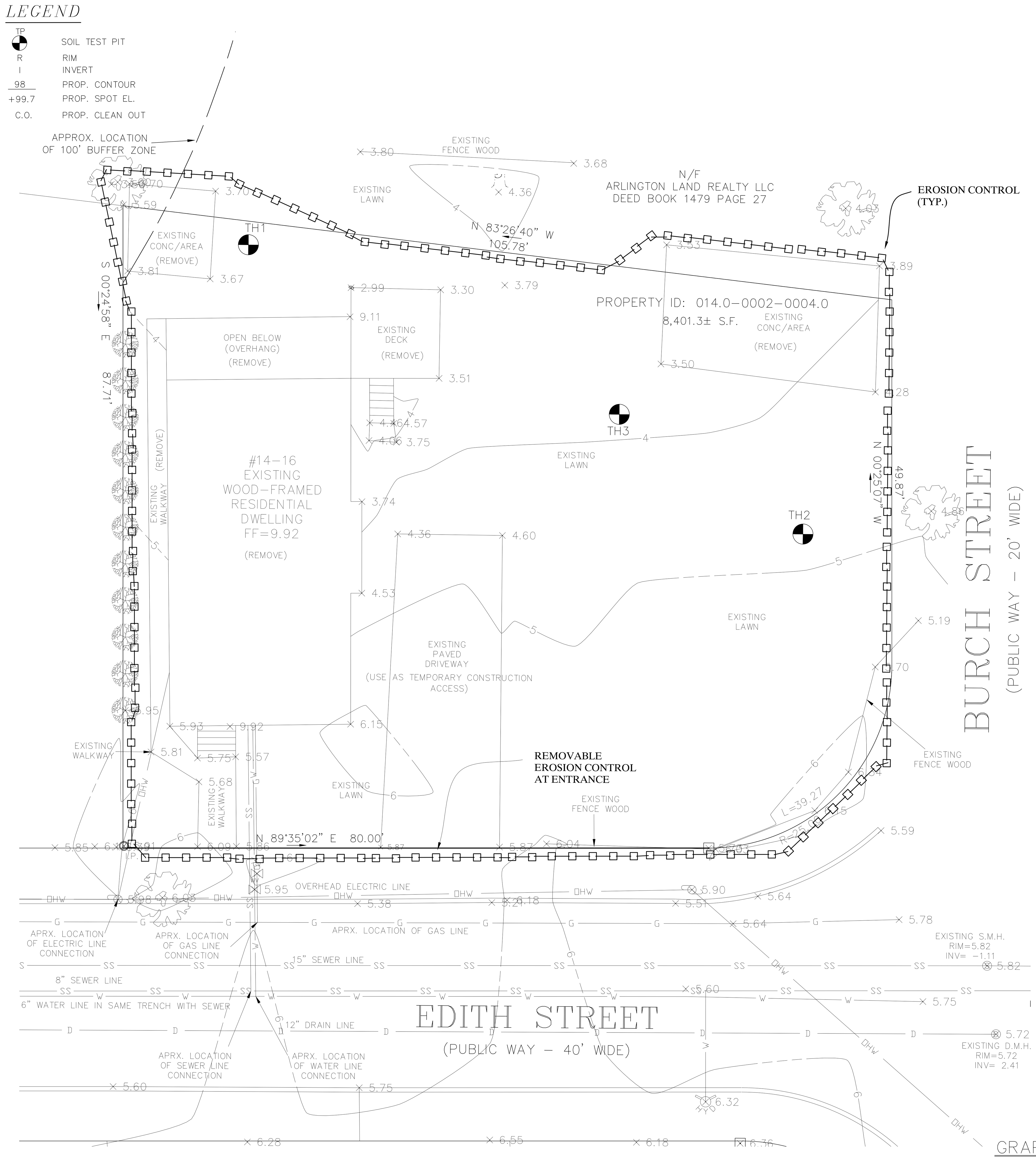
Proposed Native Restoration Plantings Plan

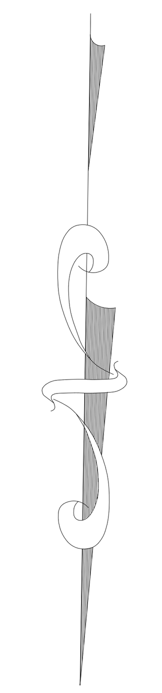
14-16 Edith Street, Arlington, MA

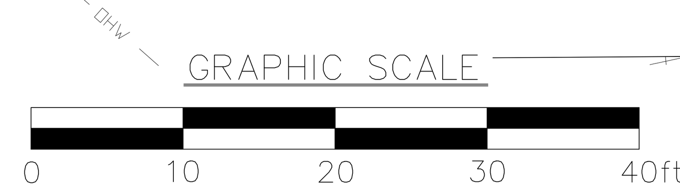
SCALE 1" = 8' - 0"
DATE 10/04/2022
DRAWING # LP - 1.0

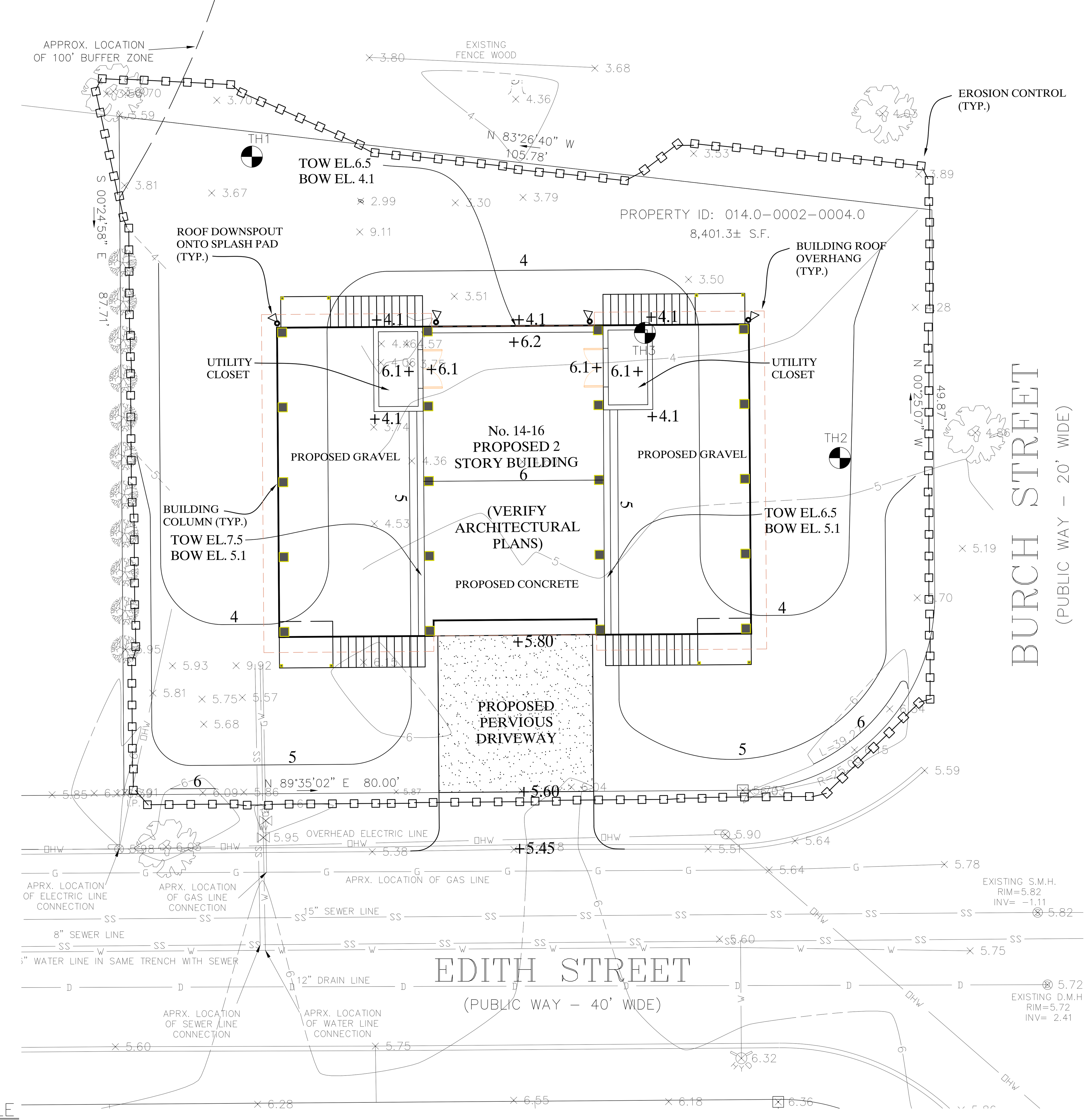
Appendix D

Drainage Plan,
dated October 18, 2022, prepared by Gala Simon Associates, Inc.









EXISTING SITE PLAN

SCALE: 1" = 10'

PROPOSED SITE PLAN

SCALE: 1" = 10'

SOIL TEST DATA

Performed by Gala Simon Associates, Inc., on 7/12/22

TH1 (EL. 3.5)

Horizon	Depth	Color	Texture	Mottles	Other	Elevation
A	30"	N/A	FILL	-	-	1.0
B	38"	7.5YR5/3	LS	-	-	0.3
C	76"	10YR7/1	FS	-	-	-2.8

WATER @52" EL.-0.8, MOTTLING @38"
ESHGW EL.0.3 (TOP OF C HORIZON)

TH2 (EL. 4.8)

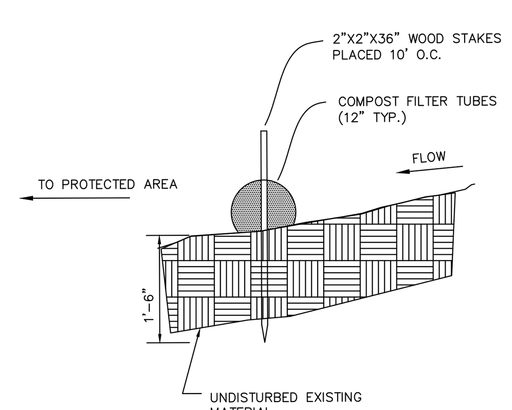
Horizon	Depth	Color	Texture	Mottles	Other	Elevation
A	10"	N/A	FILL	-	-	4.0
B	46"	7.5YR6/4	FS	-	-	1.0
C	126"	Gley2 6/10B	M/F S	-	-	-5.7

WATER @96" EL.-3.2, MOTTLING @46"
ESHGW EL.1.0 (TOP OF C HORIZON)

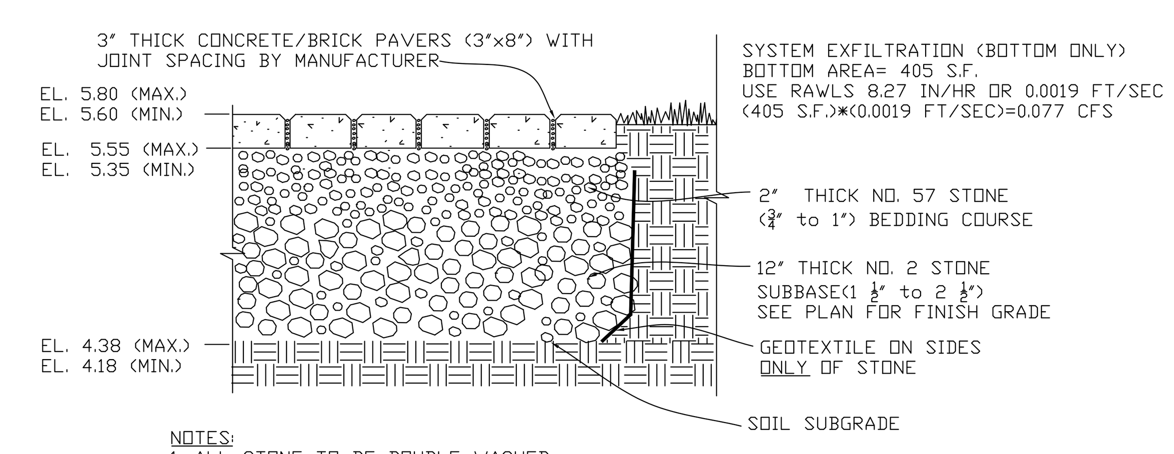
TH3 (EL. 3.9)

Horizon	Depth	Color	Texture	Mottles	Other	Elevation
A	12"	N/A	FILL	-	-	2.9
B	50"	7.5YR6/4	FS	-	-	-0.3
C	104"	Gley2 6/10B	M/F S	-	-	-4.8

WATER @74" EL.-2.3, MOTTLING @50"
ESHGW EL.-0.3 (TOP OF C HORIZON)



1/C-0 **EROSION CONTROL**
SCALE: NTS



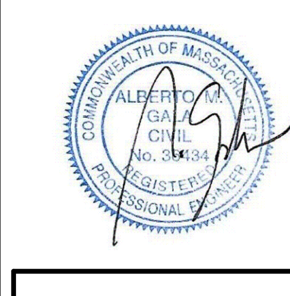
2/C-0 **CONCRETE/BRICK PERVIOUS PAVERS**
SCALE: NTS (DRIVEWAY)

Gala Simon Associates Inc.
394 LOWELL STREET, SUITE 18
LEXINGTON, MA 02420
Tel: (781) 676-2962
Gala Simon Associates
GSA
Civil Engineers

DRAINAGE PLAN

14-16 EDITH STREET
ARLINGTON, MASSACHUSETTS

Job No. 2220	Date: 10/18/22	
Drawn By: TG	Scale: AS SHOWN	
Rev#	Date:	Description:



C-0

GENERAL NOTES

1. EXISTING CONDITIONS SURVEY INFORMATION OBTAINED FROM SPRUHAN ENGINEERING, P.C., NEWTON, MA.
   OWNER/CLIENT ASSUMES ALL RESPONSIBILITY FOR SOURCES AND AUTHORIZATION TO USE ELECTRONIC AND RECORD FILES.
2. THE CONTRACTOR SHALL VERIFY ALL EXISTING INFORMATION ON THE GROUND AND SHALL REPORT ALL DISCREPANCIES TO THE ENGINEER IMMEDIATELY FOR A DECISION PRIOR TO CONSTRUCTION.
3. ALL AREAS OUTSIDE OF THE LIMIT OF WORK LINES SHALL NOT BE DISTURBED IN ANY MANNER BY THE CONTRACT OPERATIONS. THE CONTRACTOR SHALL KEEP OUT OF THESE AREAS AND PRESERVE THEIR EXISTING CHARACTER.
4. INSTALL TEMPORARY EROSION CONTROL MEASURES PRIOR TO CONSTRUCTION FOR APPROVAL BY THE DESIGN ENGINEER. EROSION CONTROL IS THE RESPONSIBILITY OF THE CONTRACTOR.
5. PROVIDE SMOOTH TRANSITION AT CHANGES IN GRADE EXCEPT AS INDICATED ON THE DRAWINGS AND AS DIRECTED BY THE ENGINEER.
6. THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL UNDERGROUND UTILITIES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL UNDERGROUND UTILITY LINES; ACTIVE OR NOT, AND SHALL MAINTAIN A CLOSE AND CONSTANT CONTACT WITH ALL UTILITY COMPANIES INVOLVED. CALL DIG-SAFE 888-344-7233
   THE TOWN OF ARLINGTON IS NOT A MEMBER OF DIG-SAFE. WHEN ACTIVITIES REQUIRE A DIG-SAFE MARKOUT, THE TOWN OF ARLINGTON SHALL BE CONTACTED AT 781-316-3310 TO REQUEST A MARKOUT.
7. ALL ELEVATIONS ARE REFERENCED TO NAVD88.
8. CONTRACTOR SHALL COMPLY WITH ALL REQUIREMENTS, PERMITTING, AND LICENSES ISSUED AT THE FEDERAL, STATE AND LOCAL AGENCIES.
9. CONTRACTOR SHALL COORDINATE ALL SITE UTILITY IMPROVEMENTS WITH THE TOWN OF ARLINGTON OFFICIALS.
10. ENGINEER IS TO BE CONTACTED BY CONTRACTOR TO PERFORM AS BUILT MEASUREMENTS.
11. OWNER/DEVELOPER IS TO COMPLY WITH ALL OF MASSACHUSETTS DEP SITE DEVELOPMENT REGULATIONS.
12. THE CONTRACTOR SHALL COORDINATE WITH THE DESIGN ENGINEER AND THE TOWN OF ARLINGTON ENGINEERING DIVISION TO PERFORM INSPECTION OF 1) BOTTOM OF EXCAVATION AND 2) SYSTEM AFTER INSTALLATION BUT PRIOR TO BACKFILL. THE ENGINEERING DIVISION SHALL BE NOTIFIED A MINIMUM OF 24-HOURS PRIOR TO THE DESIRED INSPECTION.
13. THE CONTRACTOR/OWNER SHALL ARRANGE FOR THE DESIGN ENGINEER TO DEVELOP AN AS-BUILT PLAN OF ALL IMPERVIOUS AREAS ON THE SITE FOR SUBMITTAL TO THE TOWN OF ARLINGTON ENGINEERING DIVISION.
14. PROPOSED GRADING AND DOWNSPOUT OVERFLOWS SHALL NOT DIRECT RUNOFF TOWARDS ABUTTING PROPERTIES. RUNOFF SHOULD NOT BE DIRECTED ACROSS ADJACENT PROPERTY LINES.
15. ADEQUATE MEASURES SHALL BE TAKEN TO PREVENT RUNOFF SEDIMENT FROM THE SITE COLLECTING ON THE SIDEWALK, ROADWAY, OR ABUTTING PROPERTIES DURING CONSTRUCTION ACTIVITIES. THE CONTRACTOR SHALL REMOVE ALL SEDIMENT OR PRODUCTS OF EROSION FROM THE RIGHT OF WAY WHEN NECESSARY AND COMPLETE PERIODIC SWEEPING OF THE STREETS.
16. THE TOWN OF ARLINGTON UPDATE GENERAL NOTE #6 TO INDICATE THE TOWN OF ARLINGTON WATER AND SEWER DIVISION SHOULD BE CONTACTED AT 781-316-3310 TO REQUEST A MARKOUT.
17. ADDITIONAL PERMITTING WILL BE REQUIRED THROUGH THE ARLINGTON ENGINEERING DIVISION FOR PROPOSED UTILITY CONNECTIONS, SIDEWALK WORK, AND CURB CUT WORK.

OPERATION & MAINTENANCE NOTES (PERVIOUS PAVERS)

CONTROL OF SEDIMENT IS IMPORTANT TO MAINTAIN THE PERMEABILITY OF PERVIOUS PAVERS. THE PERFORMANCE OF THE PAVERS SHALL BE VERIFIED BY THE IN-FIELD TEST METHODOLOGY DESCRIBED IN ASTM C-1701 UPON COMPLETION OF PAVING ACTIVITIES.

ENSURE PROPER OPERATION OF PERVIOUS PAVERS:
- KEEP SILT AND DEBRIS FROM ENTERING ONTO THE PERVIOUS PAVERS.
- PAVERS SHALL NOT BE SEALED UNDER ANY CIRCUMSTANCES.
- SAND OR OTHER ABRASIVES FOR SNOW OR ICE CONDITIONS SHALL NOT BE USED AS THEY REDUCE PERMEABILITY OF THE PAVERS.
- OBSERVE THE PAVER SURFACE FOR SIGNS OF SEDIMENT OR ORGANIC DEBRIS ACCUMULATION
- USE HIGH PERFORMANCE, REGENERATIVE AIR VACUUM EQUIPMENT TO CLEAN SURFACES. MECHANICAL BROOMS SHALL NOT BE USED.

SEMIANNUALLY INSPECTION FOR PROPER FUNCTIONING AND LOOK FOR:
- STANDING WATER ON PAVERS SURFACE.
- RUTS OR DEFORMATIONS IN PAVERS EXCEEDING ½ .
- SMALL RANDOM CRACKS SHOULD NOT BE SEALED.
- SURROUNDING VEGETATION IS TO BE WELL KEPT TO PREVENT SEDIMENTATION TO RUNOFF ONTO PAVERS.

SCHEDULED MAINTENANCE:
- INSPECT SURFACE OF PAVERS FOR EVIDENCE OF SEDIMENT DEPOSITION, ORGANIC DEBRIS, STAINING OR PONDING. IF ANY SIGN OF PONDING ARE EVIDENT, CONTACT A PROFESSIONAL PAVER CLEANER FOR HIGH PERFORMANCE VACUUMING.
- INSPECT THE INTEGRITY OF THE PAVERS. REPLACE OR REPAIR ANY AREAS THAT SHOW DETERIORATION, SUCH AS SLUMPING OR CRACKING.
- AT LEAST ONCE EVERY TWO YEARS THE PAVERS ARE TO BE VACUUMED BY A PROFESSIONAL PAVER CONTRACTOR.
- IN AREAS OF THE DRIVEWAY THAT HAVE BEEN DEEMED CLOGGED OR IMPERVIOUS, THE AREAS ARE TO BE VACUUMED AND THE PERFORMANCE OF THE PAVERS SHALL BE VERIFIED BY THE IN-FIELD TEST METHODOLOGY DESCRIBED IN ASTM C-1701.

IMPERVIOUS AREAS TABLE

	EXISTING (SF)	PROPOSED (SF)
DWELLING	1,409	2,403
DRIVEWAY	653	447
WALKWAY	259	–
PATIOS	471	–
TOTAL	2,792	2,850

LAYOUT & GRADING NOTES

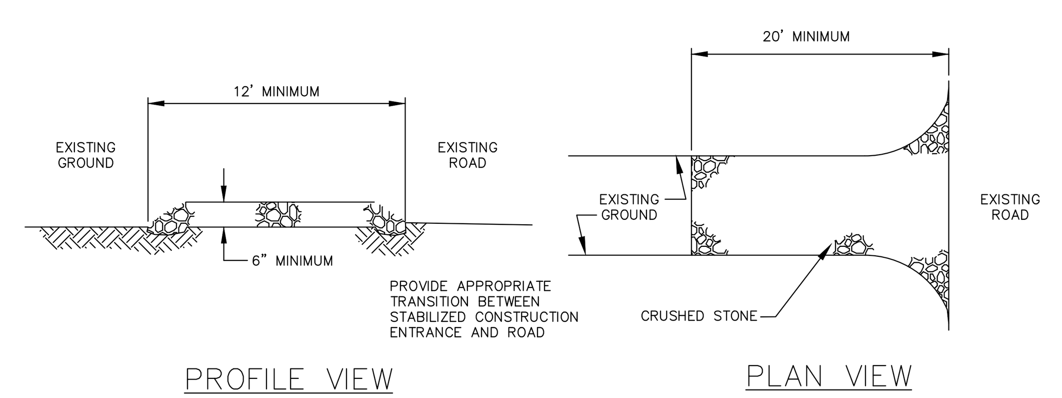
1. CONSULT ALL DRAWINGS AND SPECIFICATIONS FOR COORDINATION REQUIREMENTS BETWEEN ALL TRADES PRIOR TO COMMENCING NEW CONSTRUCTION.
2. LOCATION OF EXISTING UTILITIES SHOWN ARE DIAGRAMMATIC ONLY. CONTRACTOR SHALL CONTACT THE PROPER AUTHORITIES IN WRITING TO CONFIRM THE LOCATIONS OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK. ANY DAMAGE INCURRED DURING CONSTRUCTION TO ANY UTILITY SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL COST TO OWNER.
3. CONTRACTOR TO REFER TO A SURVEYOR PLOT PLAN FOR ACCURATE OFFSETS TO TO PROPERTY LINE.

UTILITY NOTES

THE CONTRACTOR SHALL BE RESPONSIBLE FOR VERIFYING AND DETERMINING THE LOCATION, SIZE AND ELEVATION OF ALL EXISTING UTILITIES, SHOWN OR NOT SHOWN ON THIS PLAN, PRIOR TO ANY CONSTRUCTION. THE ENGINEER SHALL BE NOTIFIED IN WRITING OF ANY UTILITIES FOUND INTERFERING WITH THE PROPOSED CONSTRUCTION AND APPROPRIATE REMEDIAL ACTION BEFORE PROCEEDING WITH THE WORK. THE LOCATION OF ALL UNDERGROUND UTILITIES SHOWN HEREON ARE APPROXIMATE AND ARE BASED ON THE FIELD LOCATION OF ALL VISIBLE STRUCTURES SUCH AS CATCH BASINS, MANHOLES, WATERGATES, ETC. AND COMPILED FROM PLANS SUPPLIED BY VARIOUS UTILITY COMPANIES AND GOVERNMENT AGENCIES. ALL CONTRACTORS SHOULD NOTIFY, IN WRITING, ALL UTILITY COMPANIES OR AGENCIES PRIOR TO ANY EXCAVATION WORK. CALL DIGSAFE AT 1-888-344-7233.

Filled Flood Storage			Compensatory Flood Storage			
El.	Area (s.f.)	Volume (c.f.)	El.	Area (s.f.)	Volume (c.f.)	Percent Increase
3.5	0		3.5	0		
		170			366	215%
4.0	682		4.0	1467		
		788			1748	221%
5.0	893		5.0	2030		
		789			1642	208%
6.0	684		6.0	1254		
		427			1225	286%
7.0	170		7.0	1197		

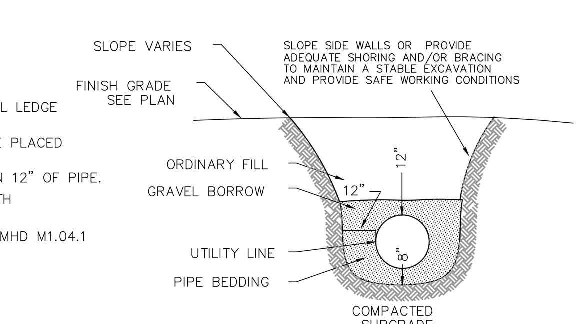
FLOOD FILL/COMP. CALCULATIONS



THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO EXISTING ROAD. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE OR ADDITIONAL LENGTH AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO EXISTING ROAD SHALL BE REMOVED IMMEDIATELY.

1 / C-1 STABILIZED CONSTRUCTION ENTRANCE
SCALE: NTS

NOTES:
1. 8" SAND CUSHION REQUIRED AT ALL LEDGE OR PIPE CROSSING
2. NO STONE GREATER THAN 3" TO BE PLACED OVER PIPE TO FINISH GRADE
3. NO STONE GREATER THAN 3" WITHIN 12" OF PIPE.
4. GRAVEL BORROW SHALL COMPLY WITH MHD M1.03.0 TYPE C..
5. PIPE BEDDING SHALL COMPLY WITH MHD M1.04.1



2 / C-1 TYP. UTILITY TRENCH
SCALE: NTS

Gala Simon Associates Inc.
394 LOWELL STREET, SUITE 18
LEXINGTON, MA 02420
Tel: (781) 676-2962
Gala Simon Associates GSA Civil Engineers

DRAINAGE PLAN

14-16 EDITH STREET
ARLINGTON, MASSACHUSETTS

Job No. 2220	Date: 10/18/22	
Drawn By: TG	Scale: AS SHOWN	
Rev#	Date:	Description:

C-1

Appendix E

Engineering Drainage Calculations,
dated November 4, 2022, prepared by Gala Simon Associates, Inc.

Engineering Drainage Calculations
for
14-16 Edith Street
Arlington, Massachusetts

Prepared by

Gala Simon Associates, Inc.
394 Lowell Street, Suite 18
Lexington, MA 02420
781-676-2962

November 4, 2022

Project: 14-16 Edith Street, Arlington, MA

Date: November 4, 2022

Project Narrative:

The project consists of the construction of a two family dwelling and associated driveway. The existing dwelling as well as the patios, walks and driveway will be removed. The proposed driveway is to be built with porous pavers.

Soils on the site are considered fill materials underlain by wet substratum per USDA soil maps. On-site soil testing performed by Gala Simon Associates, Inc., on July 12, 2022 indicate sandy soils (group A) on-site below the fill material.

The 24-hour rainfall amounts used in the hydrological calculations were obtained from the Northeast Regional Climate Center's, "Atlas of Precipitation Extremes for the Northeastern United States and Southeastern Canada."

Summary of Results:

The following table summarizes the peak flows and volumes from the property under Existing and Proposed Conditions.

Summary of Stormwater Runoff and Volume

Storm Event	***Existing Conditions Peak***		***Proposed Conditions Peak***		***Δ***	
	Runoff (cfs)	*Volume (af)*	*Runoff (cfs)*	*Volume (af)*	*Runoff (cfs)*	*Volume (af)*
2-Year (3.23 in)	0.05	0.006	0.04	0.006	-0.01	0
10-Year (4.90 in)	0.23	0.019	0.22	0.018	-0.01	-0.001
25-Year (6.20 in)	0.41	0.032	0.39	0.030	-0.02	-0.002
100-Year (8.89 in)	0.86	0.063	0.81	0.059	-0.05	-0.004

Conclusions:

1. As analyzed, the peak rates of runoff and volumes will be maintained for the 2, 10, 25 and 100 year storm events.

Project: 14-16 Edith Street, Arlington, MA

Date: November 4, 2022

Existing Conditions

Total Area:	8401 s.f.
Total Impervious Area:	2792 s.f.
Total Lawn Area:	5609 s.f.

Hydrocad Model for Existing Conditions:

Total Area:	8401 s.f
Impervious:	2792 s.f.
Lawn Area:	5609 s.f.

Hydrocad Model for Proposed Conditions

Total Area:	8401 s.f.
Infiltrated (total):	447 s.f.
Impervious:	447 s.f.
Remainder of Land (total):	7954 s.f.
Impervious:	2763 s.f.
Lawn:	5191 s.f.

The storm values were compared using the Existing Conditions node and the Proposed Conditions Remainder of Land node.

Extreme Precipitation Tables

Northeast Regional Climate Center

Data represents point estimates calculated from partial duration series. All precipitation amounts are displayed in inches.

Smoothing	Yes
State	Massachusetts
Location	
Longitude	71.147 degrees West
Latitude	42.401 degrees North
Elevation	0 feet
Date/Time	Tue, 30 Aug 2022 16:28:24 -0400

Extreme Precipitation Estimates

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.28	0.43	0.53	0.70	0.87	1.10	**1yr**	0.75	1.04	1.28	1.63	2.09	2.69	2.94	**1yr**	2.38	2.83	3.29	3.98	4.65	**1yr**
2yr	0.35	0.54	0.67	0.88	1.11	1.40	**2yr**	0.96	1.28	1.62	2.04	2.57	3.23	3.59	**2yr**	2.86	3.45	3.95	4.70	5.35	**2yr**
5yr	0.42	0.65	0.81	1.09	1.39	1.77	**5yr**	1.20	1.61	2.06	2.60	3.26	4.09	4.56	**5yr**	3.62	4.38	5.00	5.97	6.69	**5yr**
10yr	0.47	0.74	0.93	1.27	1.65	2.12	**10yr**	1.42	1.91	2.47	3.12	3.92	4.90	5.47	**10yr**	4.33	5.26	5.99	7.15	7.92	**10yr**
25yr	0.56	0.89	1.13	1.56	2.06	2.67	**25yr**	1.78	2.40	3.13	3.96	4.98	6.20	6.96	**25yr**	5.49	6.69	7.59	9.10	9.91	**25yr**
50yr	0.63	1.01	1.30	1.82	2.45	3.21	**50yr**	2.12	2.86	3.77	4.78	5.98	7.43	8.36	**50yr**	6.57	8.03	9.08	10.92	11.75	**50yr**
100yr	0.73	1.18	1.52	2.14	2.92	3.84	**100yr**	2.52	3.40	4.52	5.73	7.17	8.89	10.04	**100yr**	7.87	9.65	10.88	13.10	13.94	**100yr**
200yr	0.83	1.36	1.76	2.52	3.47	4.60	**200yr**	2.99	4.05	5.43	6.89	8.61	10.65	12.07	**200yr**	9.43	11.60	13.03	15.73	16.54	**200yr**
500yr	1.01	1.65	2.16	3.13	4.37	5.83	**500yr**	3.77	5.11	6.90	8.77	10.97	13.54	15.40	**500yr**	11.98	14.81	16.55	20.05	20.75	**500yr**

Lower Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.25	0.38	0.46	0.62	0.76	0.85	**1yr**	0.66	0.83	1.15	1.44	1.78	2.44	2.50	**1yr**	2.16	2.41	2.93	3.53	4.05	**1yr**
2yr	0.33	0.51	0.63	0.85	1.05	1.26	**2yr**	0.91	1.23	1.45	1.91	2.48	3.13	3.47	**2yr**	2.77	3.33	3.82	4.53	5.18	**2yr**
5yr	0.39	0.60	0.75	1.02	1.30	1.51	**5yr**	1.12	1.47	1.73	2.24	2.89	3.77	4.18	**5yr**	3.34	4.02	4.59	5.47	6.17	**5yr**
10yr	0.44	0.67	0.83	1.16	1.50	1.73	**10yr**	1.29	1.69	1.95	2.53	3.24	4.35	4.83	**10yr**	3.85	4.65	5.27	6.29	7.01	**10yr**
25yr	0.50	0.77	0.95	1.36	1.79	2.05	**25yr**	1.54	2.00	2.31	2.96	3.78	5.23	5.82	**25yr**	4.63	5.60	6.31	7.52	8.29	**25yr**
50yr	0.56	0.85	1.06	1.52	2.05	2.35	**50yr**	1.77	2.30	2.61	3.34	4.24	5.99	6.70	**50yr**	5.30	6.44	7.22	8.60	9.39	**50yr**
100yr	0.63	0.95	1.18	1.71	2.35	2.68	**100yr**	2.03	2.62	2.96	3.62	4.77	6.89	7.70	**100yr**	6.10	7.41	8.27	9.79	10.65	**100yr**
200yr	0.70	1.06	1.34	1.94	2.71	3.06	**200yr**	2.34	2.99	3.36	4.05	5.37	7.91	8.86	**200yr**	7.00	8.52	9.46	11.12	12.03	**200yr**
500yr	0.82	1.23	1.58	2.29	3.26	3.65	**500yr**	2.81	3.57	3.97	4.70	6.29	9.50	10.64	**500yr**	8.41	10.23	11.30	13.12	14.12	**500yr**

Upper Confidence Limits

	5min	10min	15min	30min	60min	120min		1hr	2hr	3hr	6hr	12hr	24hr	48hr		1day	2day	4day	7day	10day	
1yr	0.31	0.48	0.58	0.79	0.97	1.13	**1yr**	0.83	1.11	1.32	1.77	2.25	2.86	3.17	**1yr**	2.53	3.05	3.51	4.29	5.03	**1yr**
2yr	0.36	0.56	0.69	0.94	1.15	1.36	**2yr**	1.00	1.33	1.57	2.08	2.68	3.35	3.74	**2yr**	2.97	3.59	4.11	4.89	5.55	**2yr**
5yr	0.45	0.70	0.86	1.19	1.51	1.79	**5yr**	1.30	1.75	2.05	2.66	3.39	4.44	5.00	**5yr**	3.93	4.81	5.43	6.48	7.21	**5yr**
10yr	0.55	0.84	1.05	1.46	1.89	2.20	**10yr**	1.63	2.15	2.55	3.22	4.07	5.51	6.25	**10yr**	4.88	6.01	6.72	8.04	8.83	**10yr**
25yr	0.71	1.08	1.35	1.92	2.53	2.90	**25yr**	2.19	2.83	3.39	4.16	5.17	7.32	8.42	**25yr**	6.48	8.09	8.92	10.74	11.56	**25yr**
50yr	0.86	1.31	1.64	2.35	3.17	3.59	**50yr**	2.73	3.51	4.21	5.05	6.22	9.08	10.54	**50yr**	8.04	10.14	11.04	13.40	14.18	**50yr**
100yr	1.06	1.60	2.00	2.89	3.96	4.42	**100yr**	3.42	4.32	5.22	6.37	7.47	11.28	13.22	**100yr**	9.98	12.71	13.68	16.75	17.43	**100yr**
200yr	1.29	1.94	2.45	3.55	4.95	5.46	**200yr**	4.27	5.34	6.49	7.78	8.96	14.02	16.60	**200yr**	12.41	15.96	16.97	20.95	21.46	**200yr**
500yr	1.68	2.50	3.21	4.67	6.63	7.20	**500yr**	5.72	7.04	8.66	10.14	11.41	18.71	22.44	**500yr**	16.56	21.58	22.57	28.20	28.29	**500yr**

Powered by ACIS
Northeast Regional Climate Center

Map Scale: 1:966 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 10, 20, 40, 60

Feet: 0, 45, 90, 180, 270

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 19N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts
Survey Area Data: Version 21, Sep 2, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 22, 2022—Jun 5, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
51A	Swansea muck, 0 to 1 percent slopes	B/D	0.0	0.2%
603	Urban land, wet substratum		0.4	9.0%
655	Udorthents, wet substratum		3.6	90.8%
Totals for Area of Interest			**3.9**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

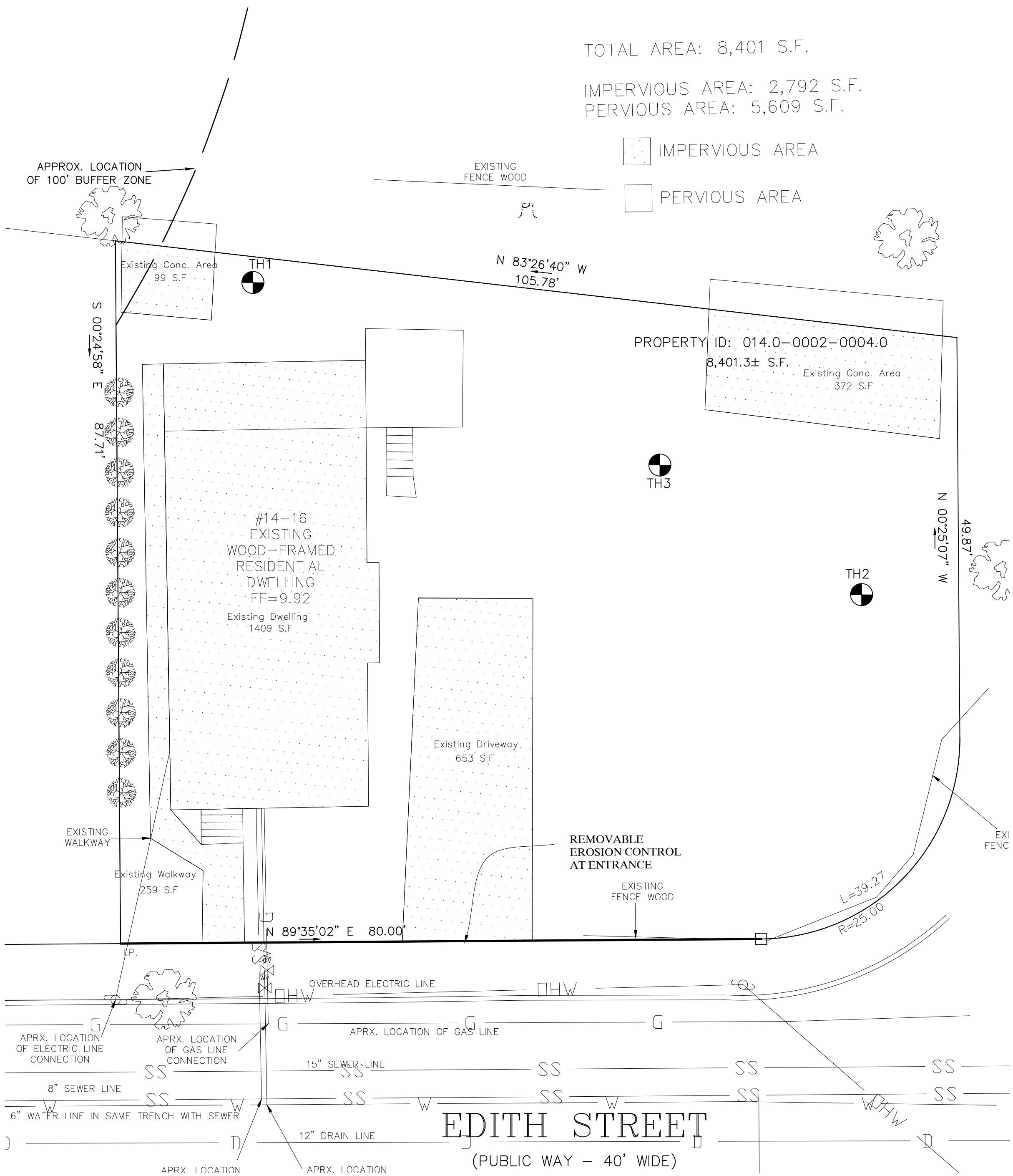
Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Drainage Delineation Plans



Gala Simon Associates

GSA

Civil Engineers

394 Lowell Street
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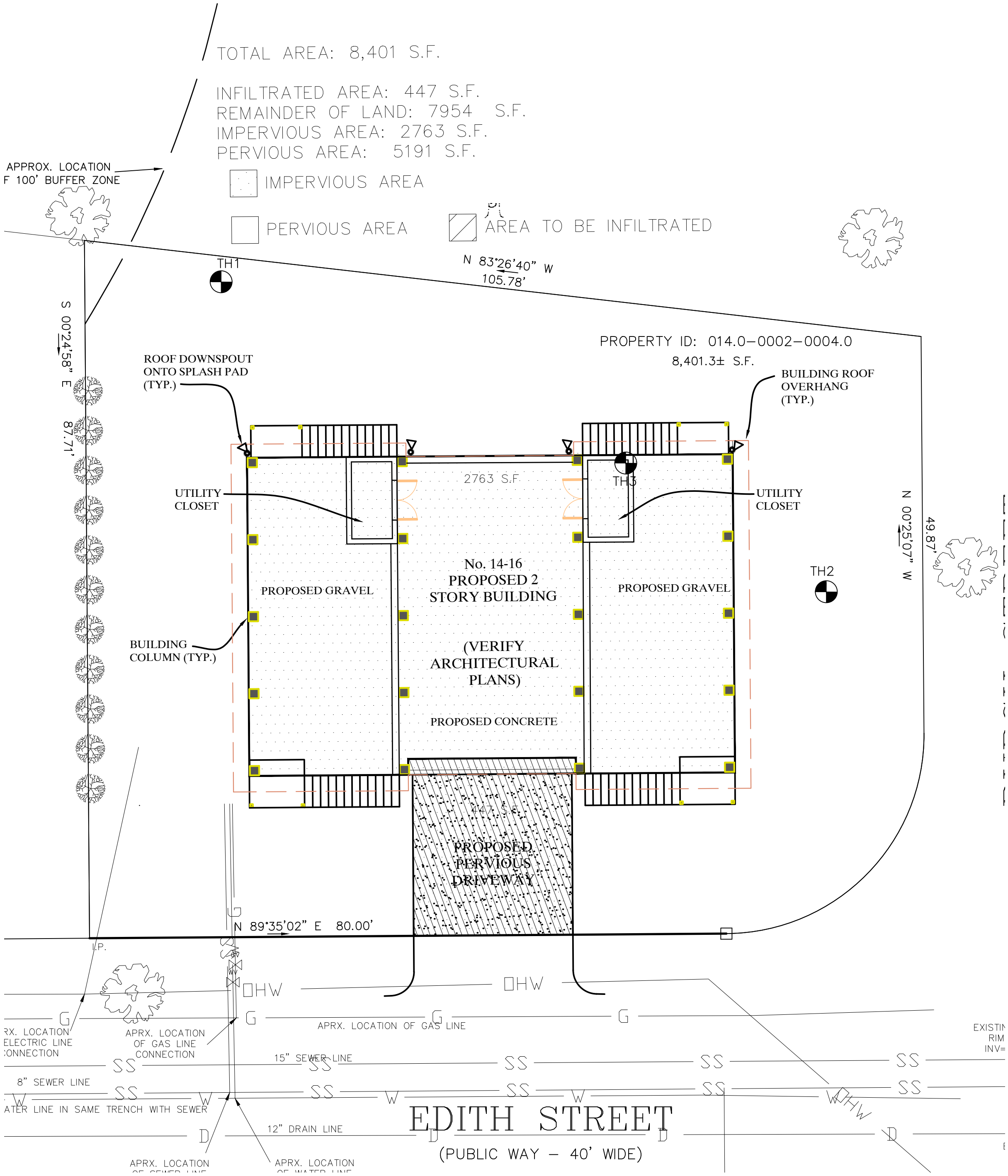
Existing Conditions
14-16 Edith Street – Arlington, MA

Scale: 1"=20'

D1

November 4, 2022



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GSA

Civil Engineers

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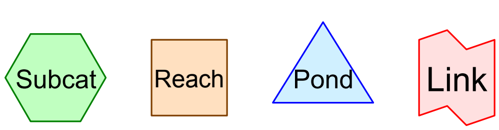
Proposed Conditions
14-16 Edith Street- Arlington, MA

Scale: 1"=20'

D2

November 4, 2022

Existing Conditions
2, 10, 25 and 100 Year Storm Events



Drainage Diagram for [2220] Existing Conditions
Prepared by Gala Simon Associates, Inc. 10/11/2022
HydroCAD® 8.00 s/n 004688 © 2006 HydroCAD Software Solutions LLC

Subcatchment 1S: Existing Conditions

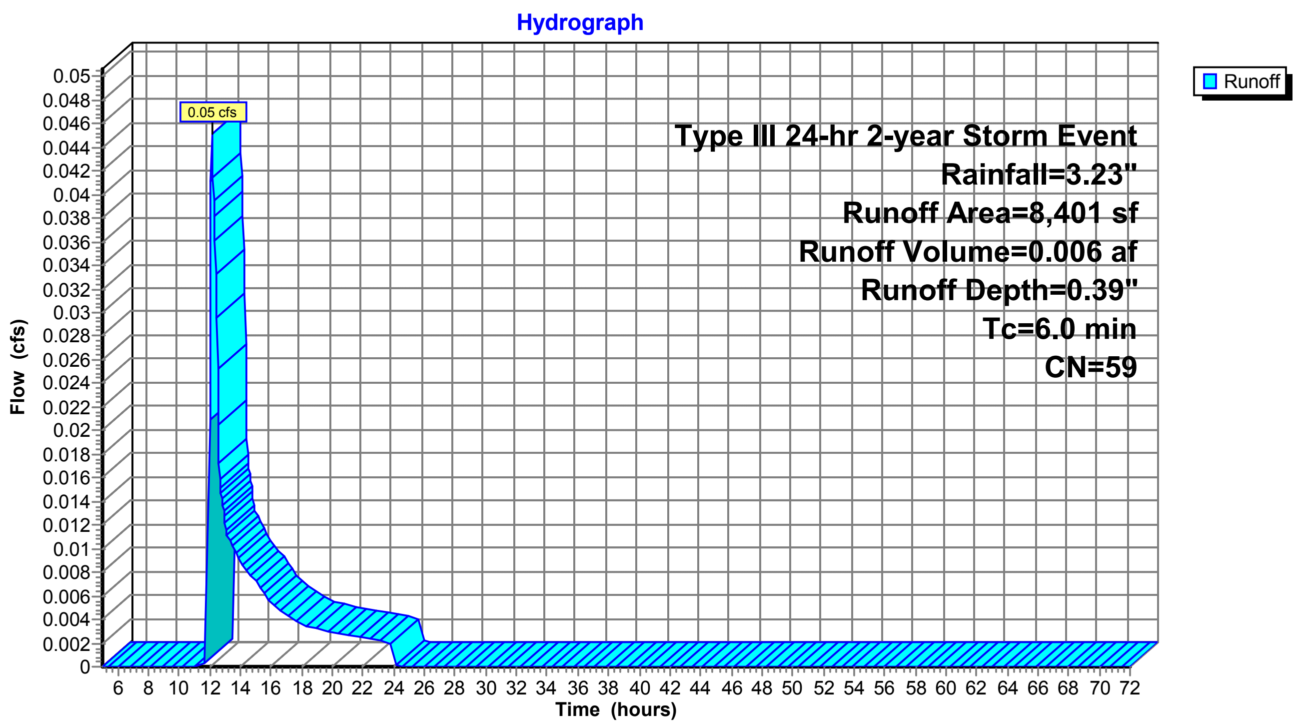
Runoff = 0.05 cfs @ 12.15 hrs, Volume= 0.006 af, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Storm Event Rainfall=3.23"

Area (sf)	CN	Description
5,609	39	>75% Grass cover, Good, HSG A
2,792	98	Paved parking & roofs
8,401	59	Weighted Average
5,609		Pervious Area
2,792		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1S: Existing Conditions



Subcatchment 1S: Existing Conditions

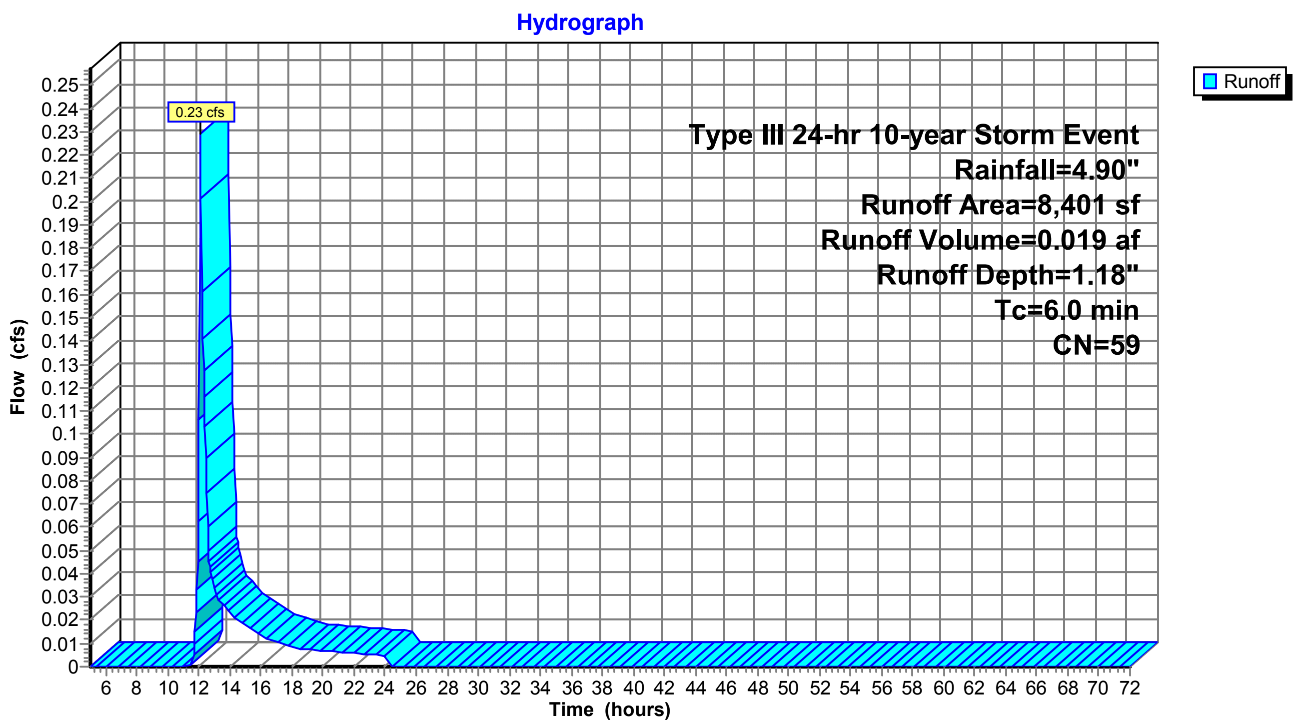
Runoff = 0.23 cfs @ 12.11 hrs, Volume= 0.019 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Storm Event Rainfall=4.90"

Area (sf)	CN	Description
5,609	39	>75% Grass cover, Good, HSG A
2,792	98	Paved parking & roofs
8,401	59	Weighted Average
5,609		Pervious Area
2,792		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1S: Existing Conditions



Subcatchment 1S: Existing Conditions

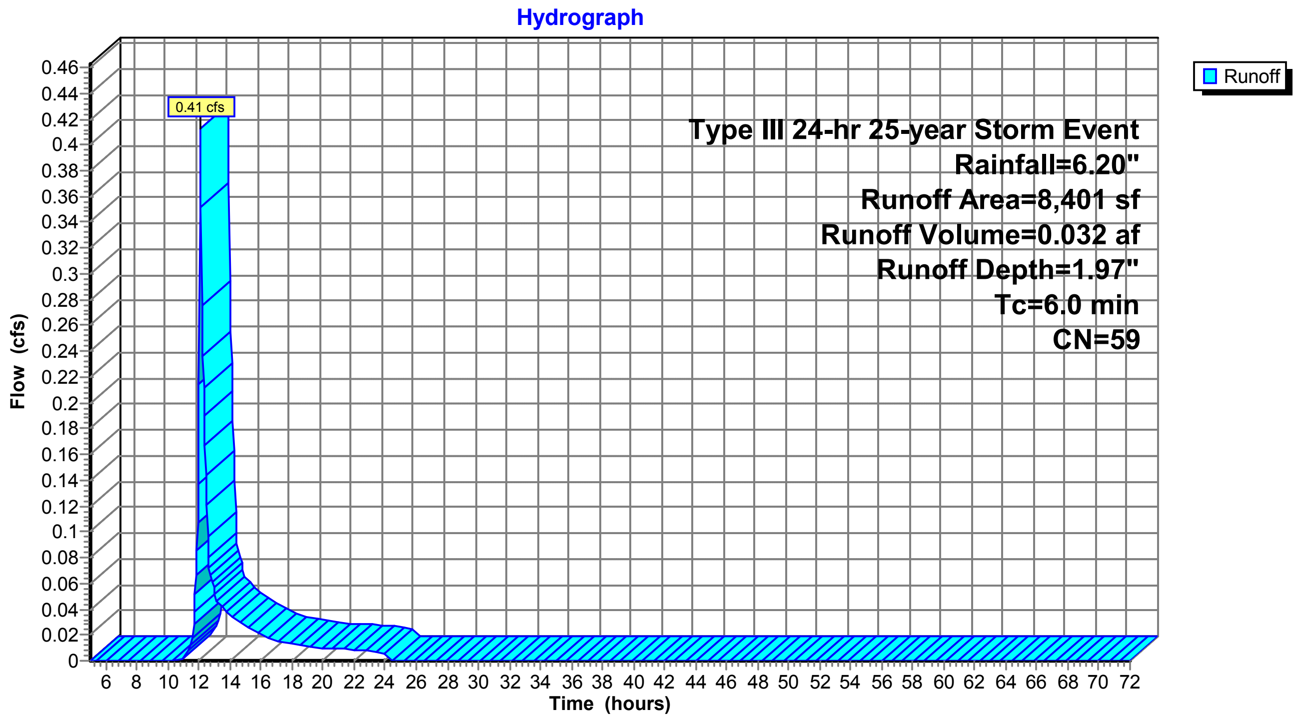
Runoff = 0.41 cfs @ 12.10 hrs, Volume= 0.032 af, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Storm Event Rainfall=6.20"

Area (sf)	CN	Description
5,609	39	>75% Grass cover, Good, HSG A
2,792	98	Paved parking & roofs
8,401	59	Weighted Average
5,609		Pervious Area
2,792		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1S: Existing Conditions



Subcatchment 1S: Existing Conditions

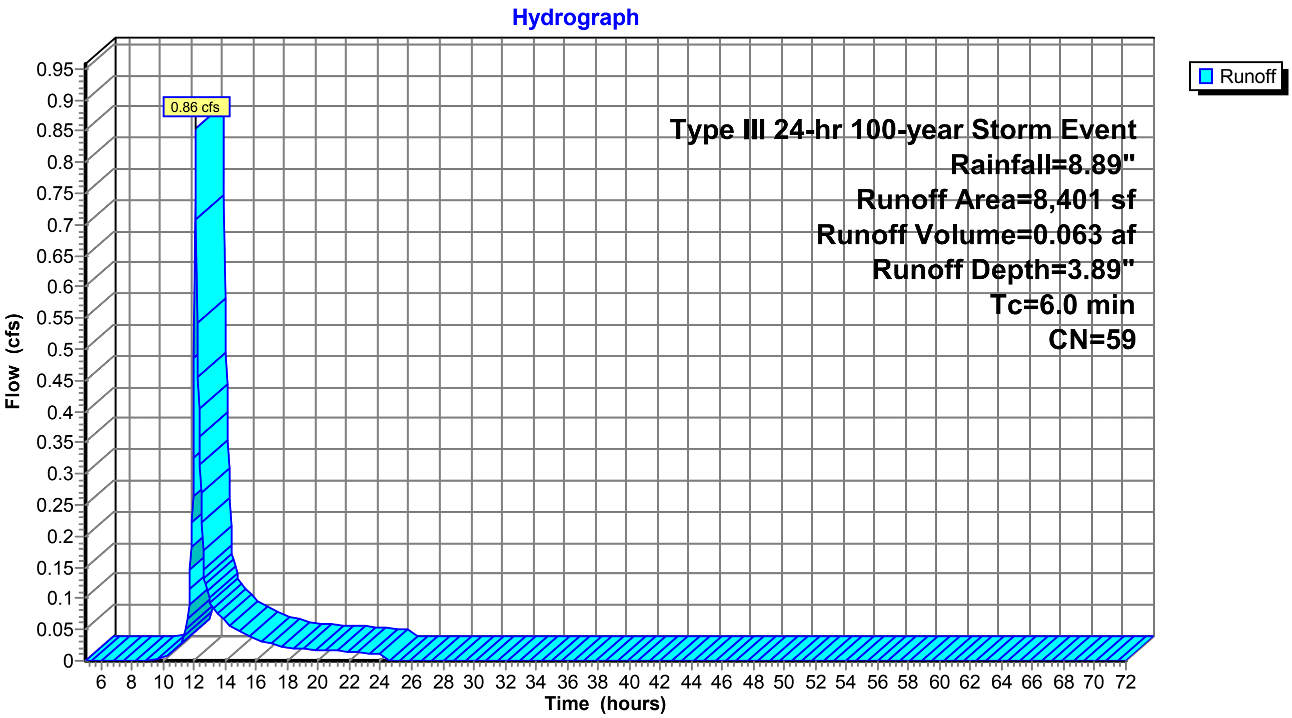
Runoff = 0.86 cfs @ 12.10 hrs, Volume= 0.063 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Storm Event Rainfall=8.89"

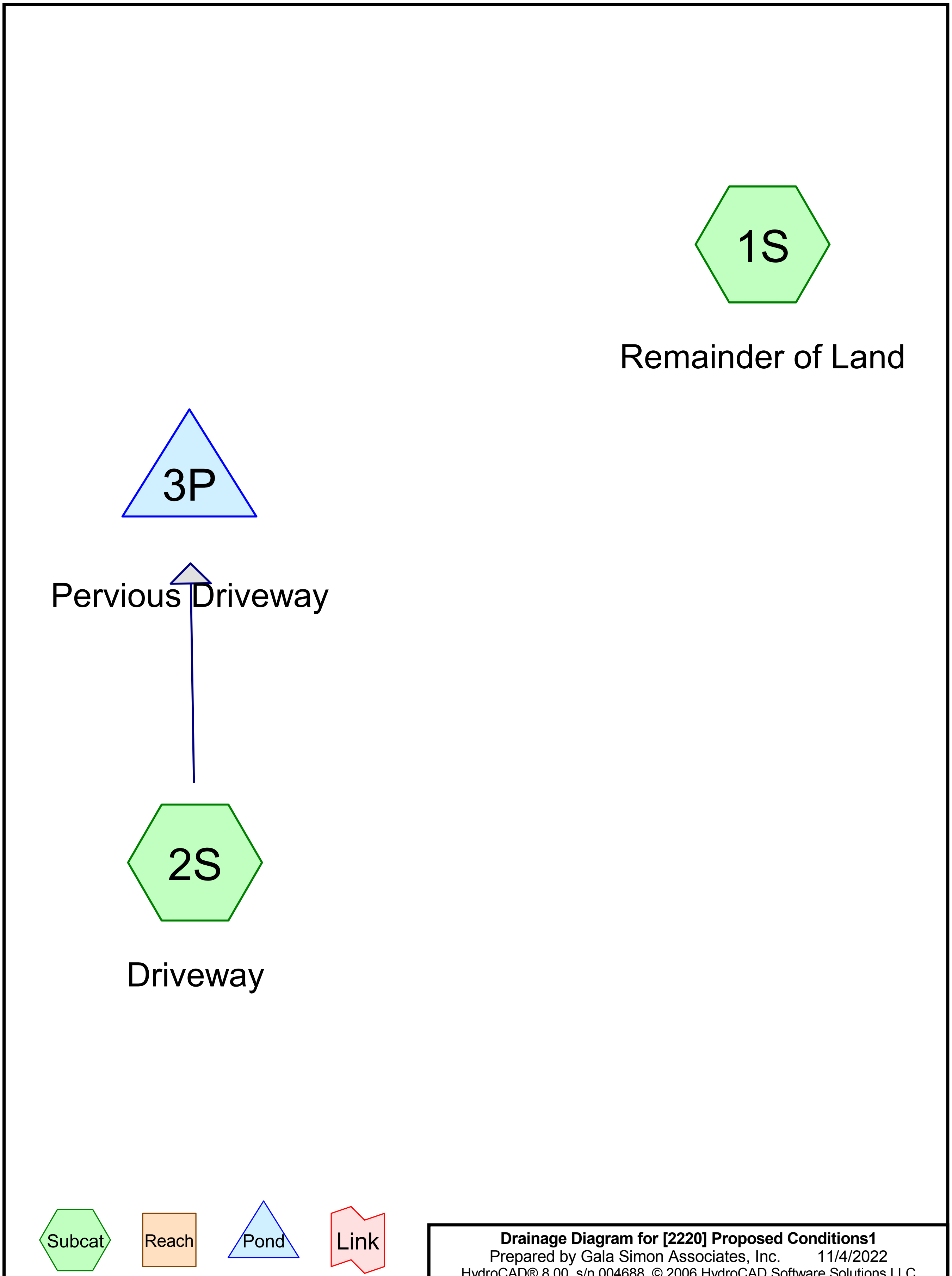
Area (sf)	CN	Description
5,609	39	>75% Grass cover, Good, HSG A
2,792	98	Paved parking & roofs
8,401	59	Weighted Average
5,609		Pervious Area
2,792		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1S: Existing Conditions



Proposed Conditions
2, 10, 25 and 100 Year Storm Events



Drainage Diagram for [2220] Proposed Conditions1
Prepared by Gala Simon Associates, Inc. 11/4/2022
HydroCAD® 8.00 s/n 004688 © 2006 HydroCAD Software Solutions LLC

Subcatchment 1S: Remainder of Land

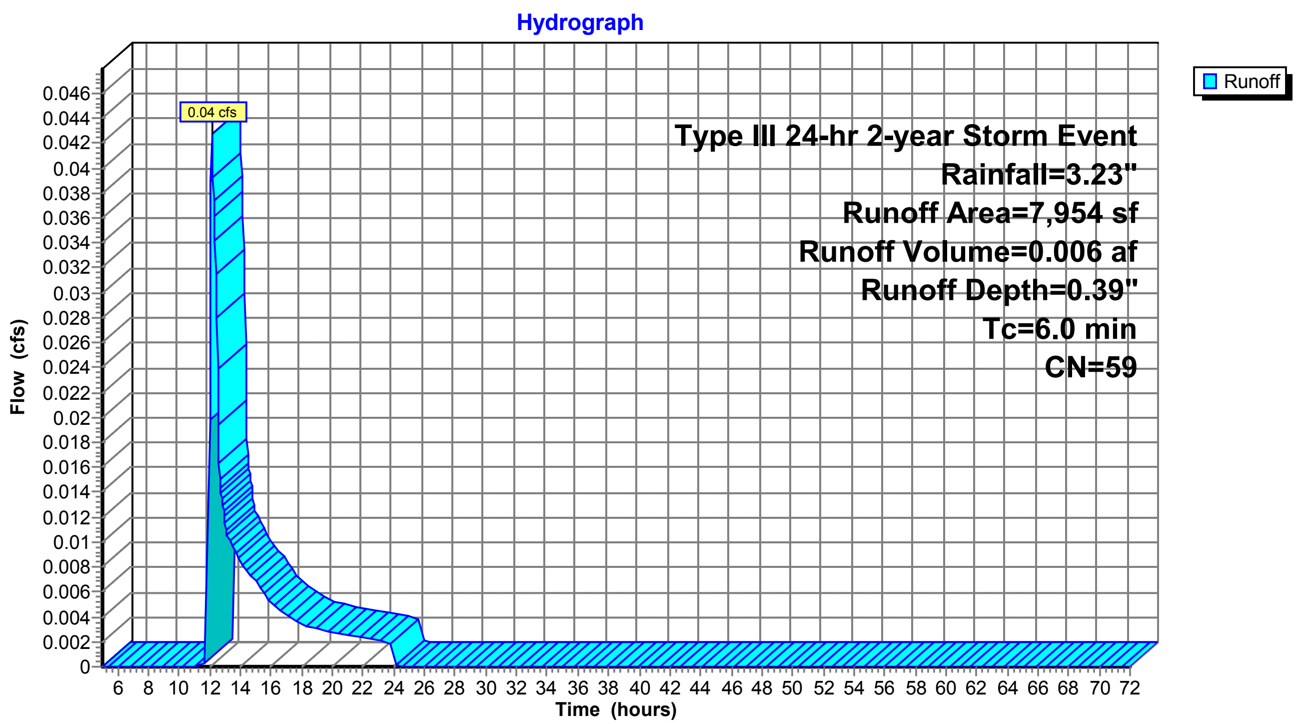
Runoff = 0.04 cfs @ 12.15 hrs, Volume= 0.006 af, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Storm Event Rainfall=3.23"

Area (sf)	CN	Description
5,191	39	>75% Grass cover, Good, HSG A
2,763	98	Paved parking & roofs
7,954	59	Weighted Average
5,191		Pervious Area
2,763		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1S: Remainder of Land



Subcatchment 2S: Driveway

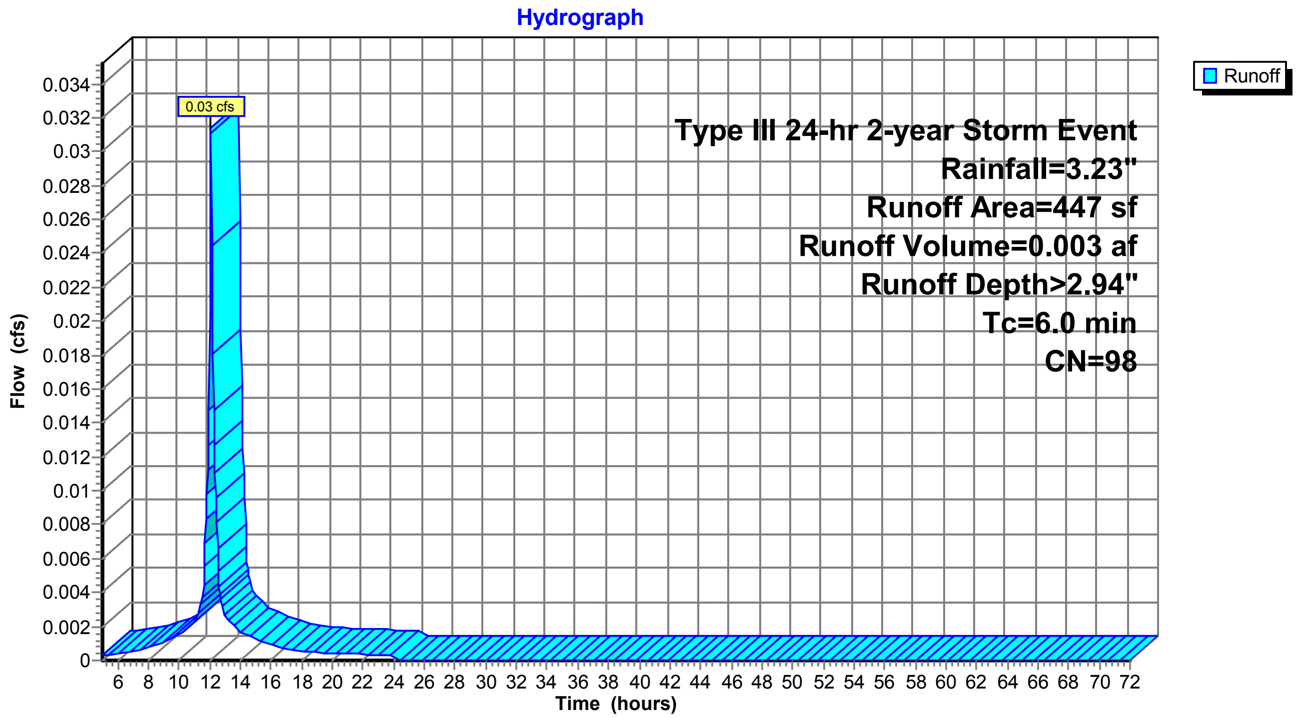
Runoff = 0.03 cfs @ 12.09 hrs, Volume= 0.003 af, Depth> 2.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-year Storm Event Rainfall=3.23"

Area (sf)	CN	Description
447	98	Paved parking & roofs
447		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2S: Driveway



Pond 3P: Pervious Driveway

Inflow Area = 0.010 ac, Inflow Depth > 2.94" for 2-year Storm Event event
Inflow = 0.03 cfs @ 12.09 hrs, Volume= 0.003 af
Outflow = 0.03 cfs @ 12.09 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.4 min
Discarded = 0.03 cfs @ 12.09 hrs, Volume= 0.003 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 4.18' @ 12.09 hrs Surf.Area= 0 sf Storage= 1 cf

Plug-Flow detention time= 0.4 min calculated for 0.003 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (766.5 - 766.1)

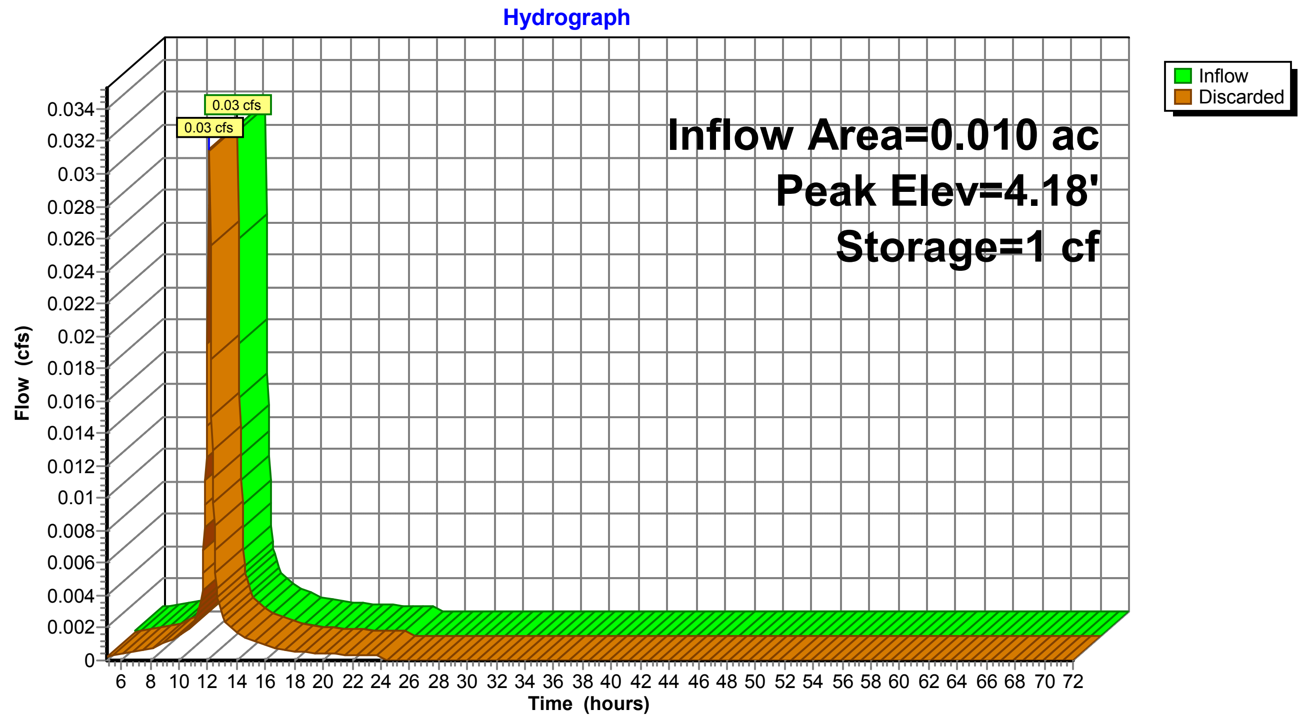
Volume	Invert	Avail.Storage	Storage Description
#1	4.18'	155 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
4.18	0
5.35	155

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**Special & User-Defined** Elev. (feet) 3.10 3.11 5.25 Disch. (cfs) 0.000 0.077 0.077

Discarded OutFlow Max=0.08 cfs @ 12.09 hrs HW=4.18' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 0.08 cfs)

Pond 3P: Pervious Driveway



Subcatchment 1S: Remainder of Land

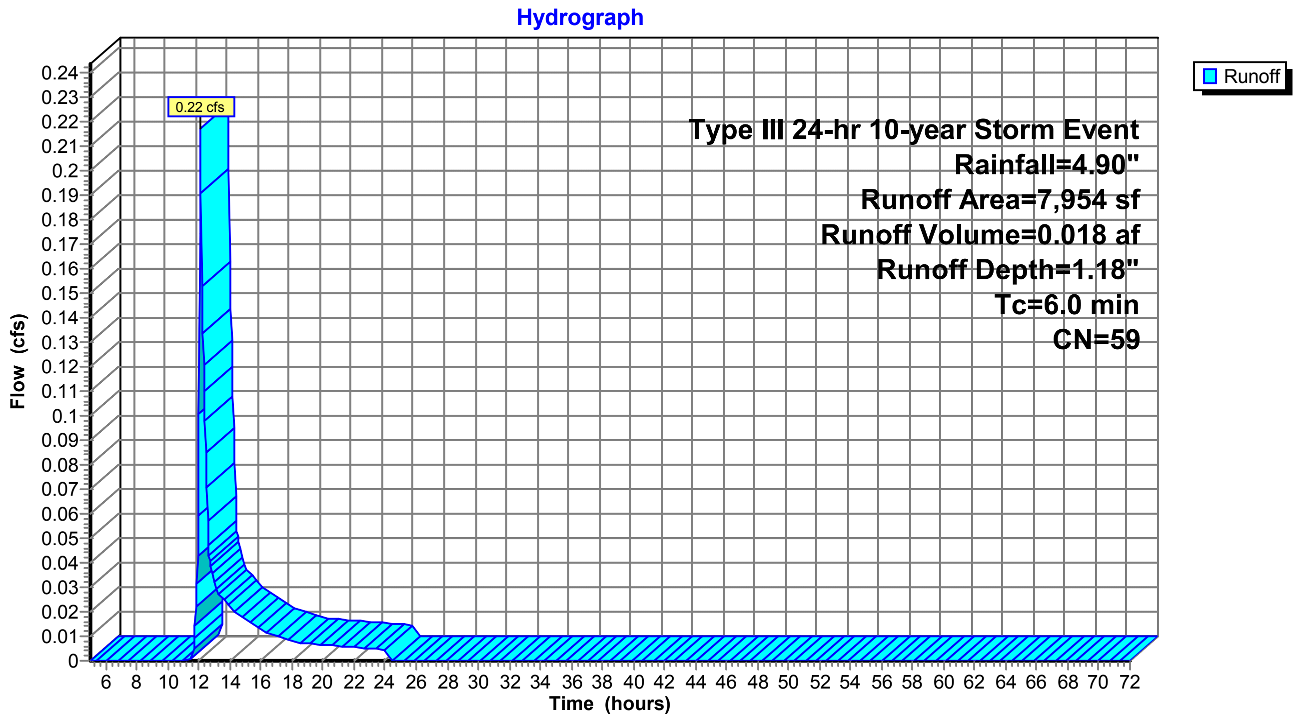
Runoff = 0.22 cfs @ 12.11 hrs, Volume= 0.018 af, Depth= 1.18"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Storm Event Rainfall=4.90"

Area (sf)	CN	Description
5,191	39	>75% Grass cover, Good, HSG A
2,763	98	Paved parking & roofs
7,954	59	Weighted Average
5,191		Pervious Area
2,763		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1S: Remainder of Land



Subcatchment 2S: Driveway

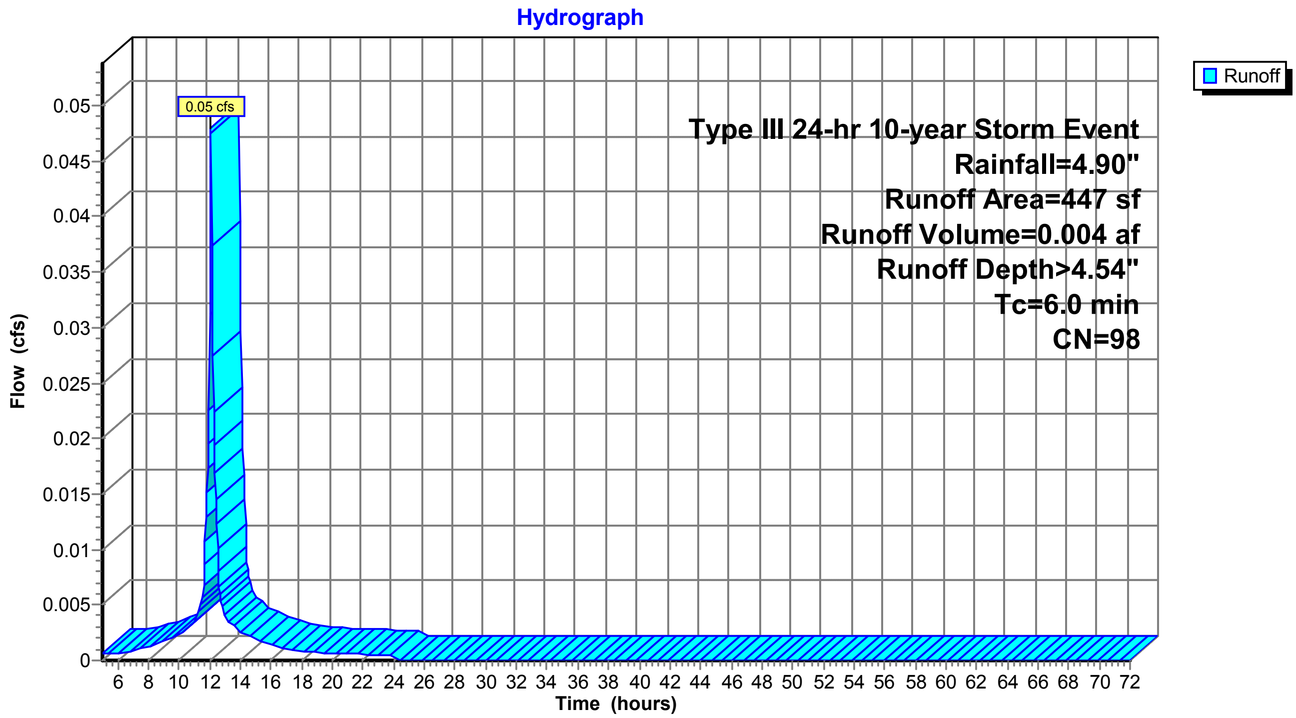
Runoff = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af, Depth> 4.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-year Storm Event Rainfall=4.90"

Area (sf)	CN	Description
447	98	Paved parking & roofs
447		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2S: Driveway



Pond 3P: Pervious Driveway

Inflow Area = 0.010 ac, Inflow Depth > 4.54" for 10-year Storm Event event
Inflow = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af
Outflow = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.4 min
Discarded = 0.05 cfs @ 12.09 hrs, Volume= 0.004 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 4.19' @ 12.09 hrs Surf.Area= 0 sf Storage= 1 cf

Plug-Flow detention time= 0.4 min calculated for 0.004 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (763.0 - 762.6)

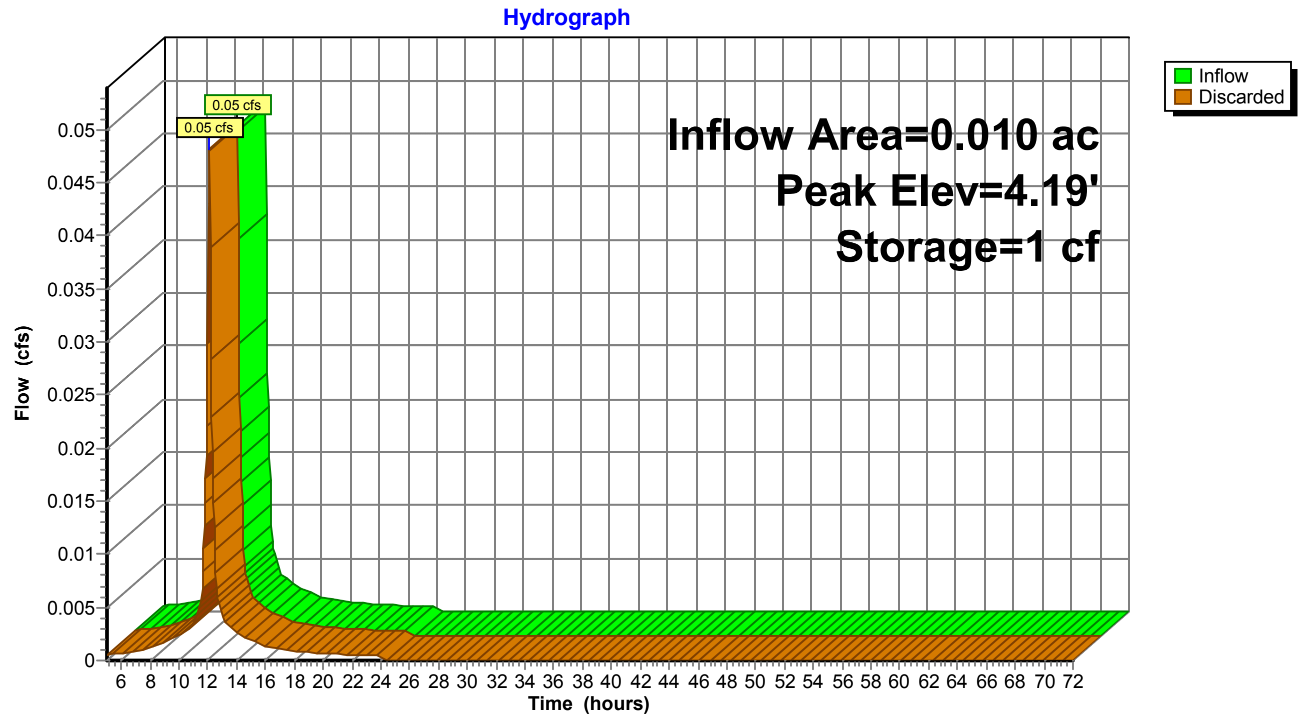
Volume	Invert	Avail.Storage	Storage Description
#1	4.18'	155 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
4.18	0
5.35	155

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**Special & User-Defined** Elev. (feet) 3.10 3.11 5.25 Disch. (cfs) 0.000 0.077 0.077

Discarded OutFlow Max=0.08 cfs @ 12.09 hrs HW=4.19' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 0.08 cfs)

Pond 3P: Pervious Driveway



Subcatchment 1S: Remainder of Land

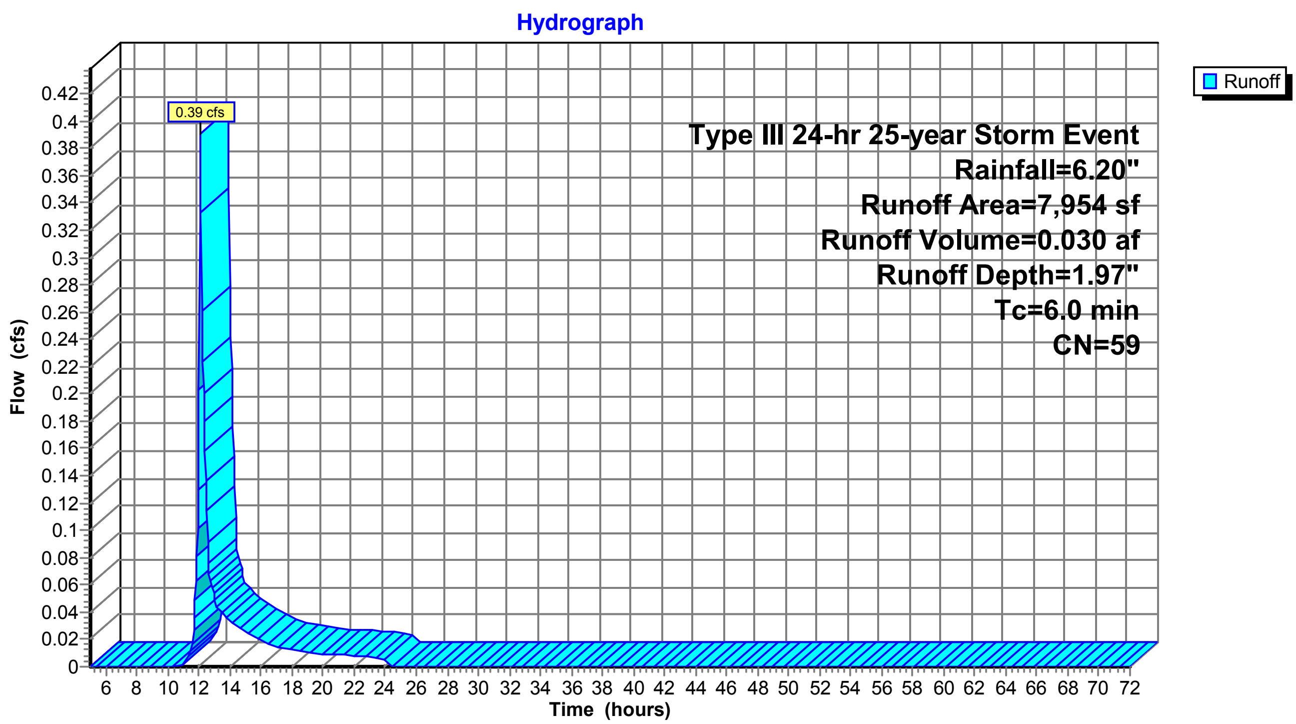
Runoff = 0.39 cfs @ 12.10 hrs, Volume= 0.030 af, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Storm Event Rainfall=6.20"

Area (sf)	CN	Description
5,191	39	>75% Grass cover, Good, HSG A
2,763	98	Paved parking & roofs
7,954	59	Weighted Average
5,191		Pervious Area
2,763		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1S: Remainder of Land



Subcatchment 2S: Driveway

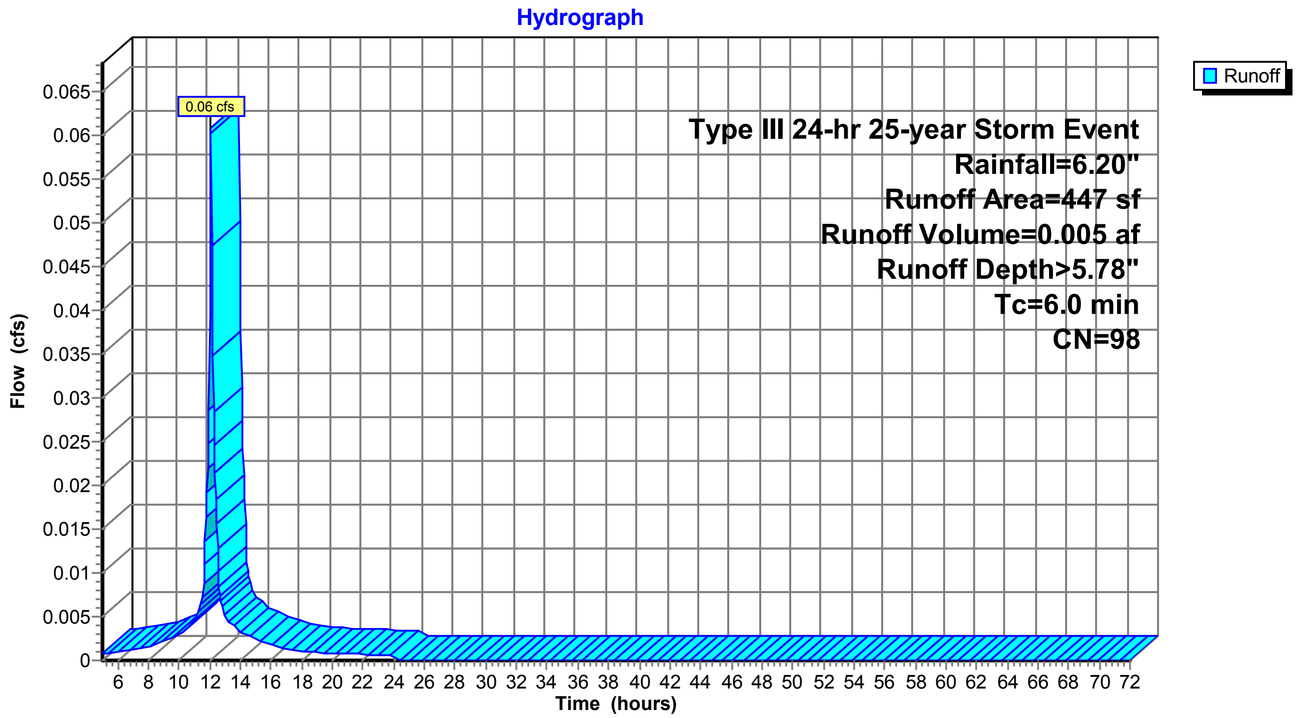
Runoff = 0.06 cfs @ 12.09 hrs, Volume= 0.005 af, Depth> 5.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-year Storm Event Rainfall=6.20"

Area (sf)	CN	Description
447	98	Paved parking & roofs
447		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2S: Driveway



Pond 3P: Pervious Driveway

Inflow Area = 0.010 ac, Inflow Depth > 5.78" for 25-year Storm Event event
Inflow = 0.06 cfs @ 12.09 hrs, Volume= 0.005 af
Outflow = 0.06 cfs @ 12.09 hrs, Volume= 0.005 af, Atten= 0%, Lag= 0.4 min
Discarded = 0.06 cfs @ 12.09 hrs, Volume= 0.005 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 4.19' @ 12.09 hrs Surf.Area= 0 sf Storage= 1 cf

Plug-Flow detention time= 0.4 min calculated for 0.005 af (100% of inflow)
Center-of-Mass det. time= 0.3 min (761.7 - 761.3)

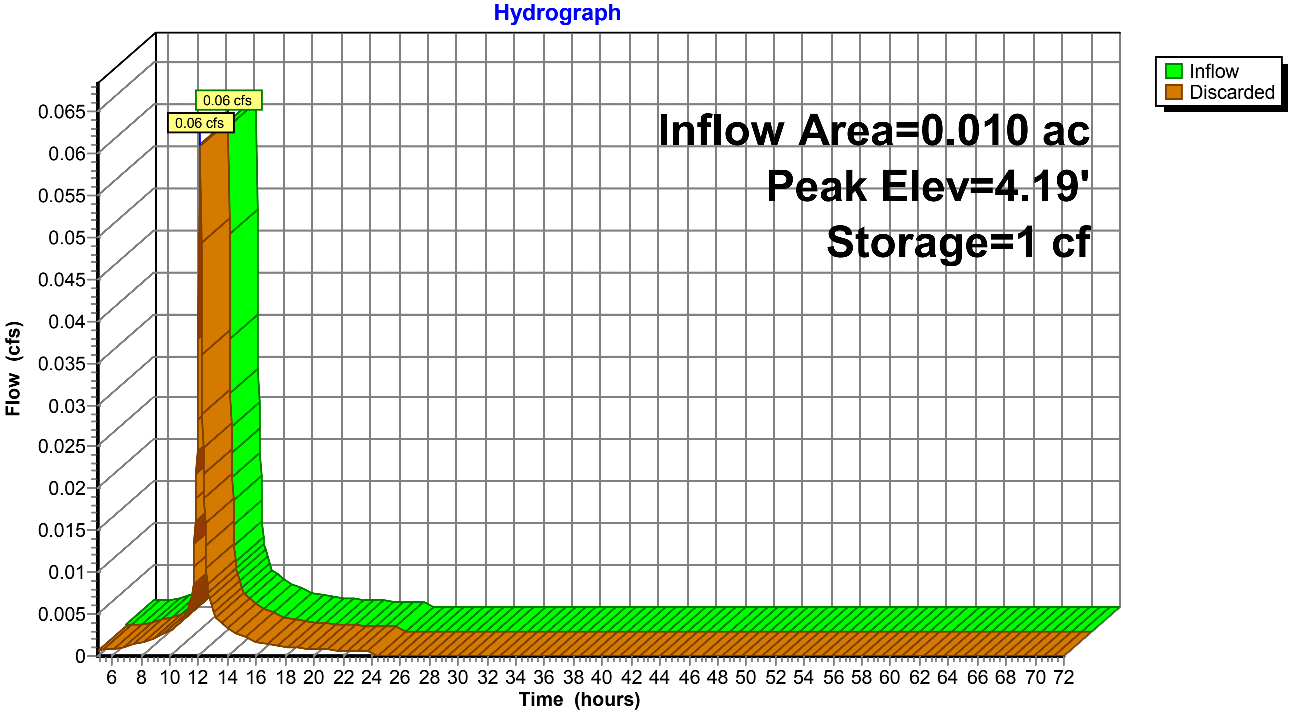
Volume	Invert	Avail.Storage	Storage Description
#1	4.18'	155 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
4.18	0
5.35	155

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**Special & User-Defined** Elev. (feet) 3.10 3.11 5.25 Disch. (cfs) 0.000 0.077 0.077

Discarded OutFlow Max=0.08 cfs @ 12.09 hrs HW=4.19' (Free Discharge)
└**1=Special & User-Defined** (Custom Controls 0.08 cfs)

Pond 3P: Pervious Driveway



Subcatchment 1S: Remainder of Land

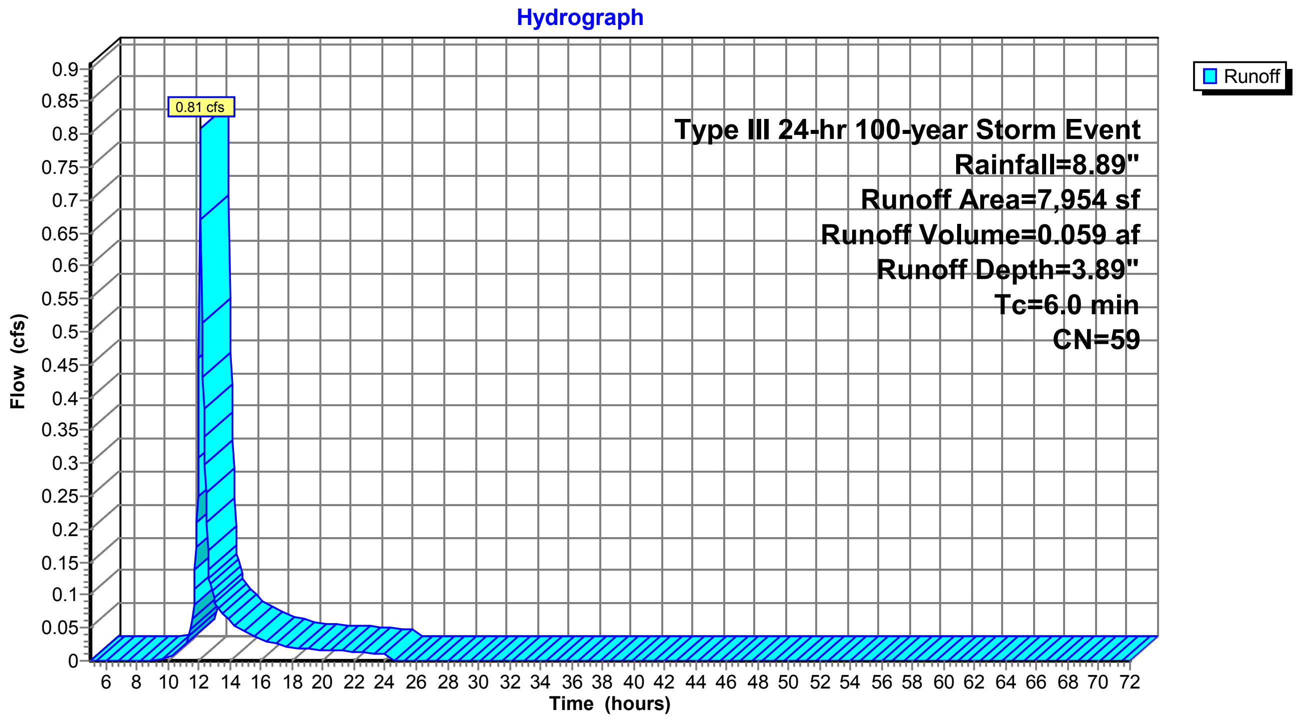
Runoff = 0.81 cfs @ 12.10 hrs, Volume= 0.059 af, Depth= 3.89"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Storm Event Rainfall=8.89"

Area (sf)	CN	Description
5,191	39	>75% Grass cover, Good, HSG A
2,763	98	Paved parking & roofs
7,954	59	Weighted Average
5,191		Pervious Area
2,763		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 1S: Remainder of Land



Subcatchment 2S: Driveway

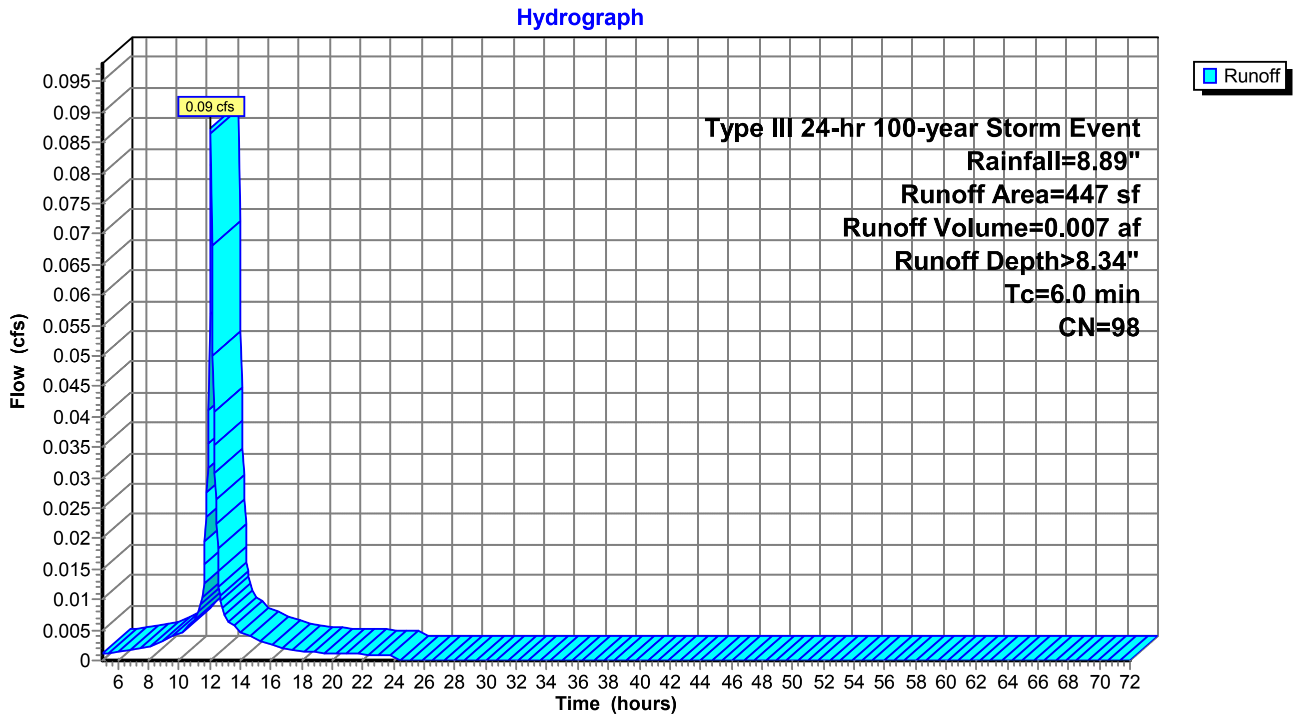
Runoff = 0.09 cfs @ 12.09 hrs, Volume= 0.007 af, Depth> 8.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-year Storm Event Rainfall=8.89"

Area (sf)	CN	Description
447	98	Paved parking & roofs
447		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry,**

Subcatchment 2S: Driveway



Pond 3P: Pervious Driveway

Inflow Area = 0.010 ac, Inflow Depth > 8.34" for 100-year Storm Event event
Inflow = 0.09 cfs @ 12.09 hrs, Volume= 0.007 af
Outflow = 0.08 cfs @ 12.05 hrs, Volume= 0.007 af, Atten= 12%, Lag= 0.0 min
Discarded = 0.08 cfs @ 12.05 hrs, Volume= 0.007 af

Routing by Stor-Ind method, Time Span= 5.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 4.20' @ 12.13 hrs Surf.Area= 0 sf Storage= 3 cf

Plug-Flow detention time= 0.4 min calculated for 0.007 af (100% of inflow)
Center-of-Mass det. time= 0.4 min (760.3 - 760.0)

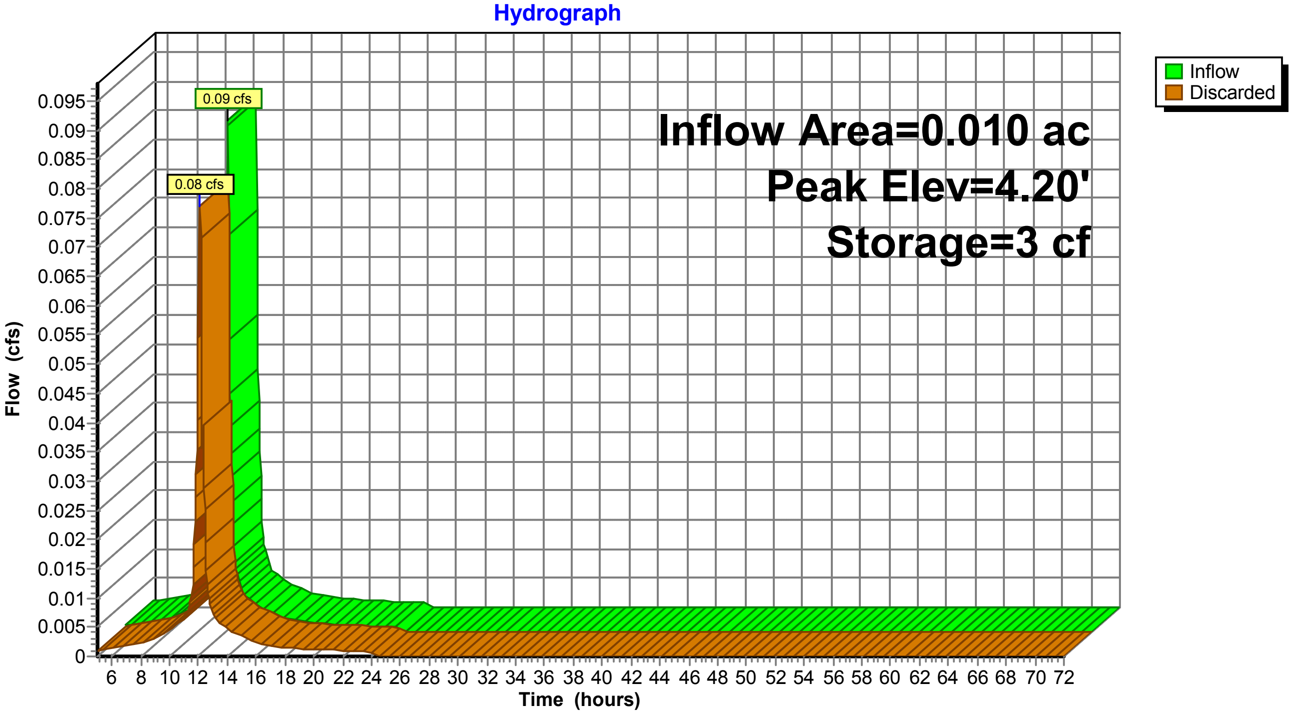
Volume	Invert	Avail.Storage	Storage Description
#1	4.18'	155 cf	**Custom Stage Data** Listed below

Elevation (feet)	Cum.Store (cubic-feet)
4.18	0
5.35	155

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.00'	**Special & User-Defined** Elev. (feet) 3.10 3.11 5.25 Disch. (cfs) 0.000 0.077 0.077

Discarded OutFlow Max=0.08 cfs @ 12.05 hrs HW=4.19' (Free Discharge)
└─**1=Special & User-Defined** (Custom Controls 0.08 cfs)

Pond 3P: Pervious Driveway



Operation and Maintenance of Drainage Systems & Construction Period Erosion and Sediment Control

Operation and Maintenance Plan for Drainage Systems

Project Name: 14-16 Edith Street, Arlington, MA

Date: November 4, 2022

Site Location: 14-16 Edith Street
Arlington, Massachusetts

Site Operator:
Owner: Albert Azatyants
Contact: 617-861-5622

The following Operation and Maintenance Plan (O & M Plan) has been developed to comply with DEP's Stormwater Management Policy. The responsibilities outlined in the O&M Plan run with ownership of the property.

Pervious Driveway

- Control of sediment is important to maintain the permeability of the pervious driveway.
- The performance of the driveway shall be verified by the in-field test methodology described in ASTM C-1701 upon completion.

Ensure proper operation of Pervious Driveway

- Keep silt and debris from entering onto the pervious driveway
- Sand or other abrasives for snow or ice conditions shall not be used as they reduce permeability of the driveway
- Observe the paver surface for signs of sediment or organic debris accumulation
- Use high performance, regenerative air vacuum equipment to clean surfaces. Mechanical brooms shall not be used.

Semiannually inspection for proper functioning and look for:

- Standing water on driveway surface.

- Surrounding vegetation is to be well kept to prevent sedimentation to runoff onto drive-way.

Yearly Scheduled Maintenance:

- Inspect surface of driveway for evidence of sediment deposition, organic debris, staining or ponding. If any sign of ponding are evident, contact a professional paver cleaner for high performance vacuuming.
- Inspect the integrity of the pavers. Replace or repair any areas that show deterioration, such as slumping or cracking.
  Estimated maintenance cost is $1000 for a vacuum service every two years.

<u>Construction Period Erosion and Sediment Control</u>

Prior to start of construction the following measures will need to be in place:

- Stake erosion control barrier on the locations shown on the site plan.

- Install the stabilized construction entrance at the beginning of the driveway to prevent sediment from entering the roadway. Sweep roadway daily during the site construction period and end of day activities. No sediment shall be left on roadway.

- After every major storm event and on a weekly basis, verify erosion control barrier is held in place properly and sediment is retained. Remove accumulated sediment and replace barrier as needed.

Town of Arlington, Massachusetts

Notice of Intent: Mystic Bridge

Summary:
Notice of Intent: Mystic Bridge

This public hearing will consider a Notice of Intent to reconstruct the Mystic Street Bridge at 0 Lot Mystic Street. Work is proposed within the Riverfront Area, Land Under Water, and Bank to Mill Brook, as well as Bordering Vegetated Wetland, and Land Subject to Flooding (Zone AE).

ATTACHMENTS:

Type	File Name	Description
Reference Material	Mystic_Street_Bridge_NOI_Application_Package_compressed_Part1.pdf	Mystic Street Bridge NOI Application Package Part 1
Reference Material	Mystic_Street_Bridge_NOI_Application_Package_compressed_Part2.pdf	Mystic Street Bridge NOI Application Part 2
Reference Material	Mystic_Street_Bridge_NOI_Application_Package_compressed_Part3.pdf	Mystic Street Bridge NOI Application Package Part 3

TOWN OF ARLINGTON
Department of Public Works
51 Grove Street
Arlington, Massachusetts 02476
Office(781) 316-3320 Fax (781) 316-3281

Engineering Division

Wednesday, November 09, 2022

David Morgan
Conservation Agent
Arlington Conservation Commission

RE: Mystic Street Bridge Replacement Project – Notice of Intent

Dear Mr. Morgan and Commissioners,

Please accept this WPA Form 3 – Notice of Intent for work proposed to reconstruct the bridge located on Mystic Street over Mill Brook. The Department of Public Works (DPW), Engineering Division has prepared the Notice of Intent submittal including supplementary documents for your review and consideration.

Additional information is provided with this submittal which follows after this cover page.

1. Project Summary
2. Resource Area Summary
3. Resource Area Delineation Plan
4. Miscellaneous Documents
    a. Mystic Street Bridge Reconstruction Project Locus Map
    b. Mystic Street Bridge – NOI Abutter Map
    c. USGS Topographic Plan – Mystic St. Bridge
    d. FEMA Firmette* - Mystic St. Bridge
    e. NHESP Atlas – Arlington
    f. Area of Critical Environmental Concern Map
    g. Arlington Block Plan Maps
    h. Project Photo Sheet

*The FEMA FIRMette notated above shows a portion of the FIRM Map; Community Panel 417E, Map Number 25017C0417E. Effective Date June 4, 2020

In addition to the supplementary information provided, a copy of the full Bridge Design set is included with this submittal. If necessary, the Hydraulic Report and Geotechnical Report performed as part of the Approved MassDOT Structural Adequacy Report can be provided if requested.

If you should have any questions or would like to discuss this application further, please feel free to contact me at 781-316-3321.

Sincerely,

Wayne A. Chouinard, P.E.
Arlington Town Engineer
51 Grove Street
Arlington, MA 02476
Office: 781-346-3321

PROJECT SUMMARY

The Mystic Street Bridge spans Mill Brook and was originally constructed circa 1850. The original substructure consists of granite blocks and stone masonry abutments which form the edges of the channel of the brook beneath the bridge. The original superstructure utilizes granite slabs that span the top of the abutments. Additional work was performed during a widening project in 1958, which utilized reinforced concrete slabs to reinforce and widen the bridge. At some unknown time after 1958 additional steel I-beams were added with concrete and is surmised to have occurred as a maintenance project to re-inforce and expand the bridge during the installation of the Boston Edison Electric Transmission Main installed in the mid-1970's.

The bridge has recently been identified to be in poor condition by inspections performed by the Massachusetts Department of Transportation (MassDOT). In anticipation of replacing the bridge, the DPW submitted capital requests to provide funding for design and construction between 2016 and 2018 as well as receiving a $500,000 grant from the MassDOT Municipal Small Bridge Program in 2017

The Department of Public Works; Engineering Division coordinated the development of design team of engineering consulting firms to prepare the design required to reconstruct the bridge. The main goal was to provide a design that would meet the structural requirements for the anticipated traffic and volume while also minimizing disturbances to Mill Brook and maintaining the existing hydraulic conditions to comply with regulatory requirements. Gill Engineering, which specializes in bridge design, provided the design and Geotechnical Report and Weston & Sampson Engineers performed the hydraulic analysis and prepared the Hydraulic Report. The full complement of data, requirements and design plans were submitted to MassDOT and has subsequently received approval of the required Structural Adequacy Report required for construction. The full submission is provided with this submittal.

The Engineering Division worked with the Design Team and engineers from the utility companies with infrastructure located within Mystic Street to develop the final plan. The result is a carefully designed bridge that will be constructed in three (3) stages [see plan sheet 4 of 25], that will allow traffic to travel in both directions throughout the project. This was a critical requirement due to the close proximity of the Arlington Police Department and Armstrong Ambulance Company which require unfettered accessibility in order to respond to calls on either side of the bridge.

There are numerous existing utilities located within Mystic Street. Currently the majority of utilities are located within an area of approximately 3ft depth of soil located above the original granite beams and concrete slabs. The design takes into account the needs for each specific utility line and provides a utility corridor between the proposed 2ft steel I-beams and beneath the bridge surface consisting of an 8-3/4" bridge deck. Work includes the necessary work to re-construct and re-align the existing utilities at the approach to the bridge in order to coincide with specific design corridor locations beneath the bridge.

Utilities:

Existing utilities located within Mystic Street are as follows:

- Town Water Lines (2)
- Town Sewer Lines (1)
- Town Sewer Siphon Chambers (2)
- MWRA Sewer Line (1)
- National Grid Gas Distribution Mains (2)
- Eversource Electric Distribution Duct Banks (2)
- Verizon Communication Duct Bank (1)
- Eversource 345kV Electric Transmission Lines (2)

The utility work will be performed within the public right of way with the majority of the utilities located between the curb lines of Mystic Street and should have no impact on the adjacent resource areas. y with the exceptions of new abutment wing walls, bank stabilization, and required bank restoration in conjunction with the requirements and recommendations of the Hydraulic Report

Bridge Construction; sub structure:
The proposed design provides a construction sequence that removes the superstructure of the existing bridge and constructs the new bridge over the existing substructure in three (3) phases. The new substructure of the bridge consists of micro-piles, and concrete abutments poured integrally around the pile caps. Based on the collected geo-technical data it is anticipated that the micro-piles will be driven to a depth of approximately 37 feet and the superstructure will be supported on the concrete abutments. This work will take place behind the foundations, abutments and channel walls of the existing bridge which will maintain the existing hydraulic conditions of the Brook and minimize disturbances.

Bridge Construction; super structure:
The proposed superstructure include a steel reinforced concrete bridge deck including roadway, sidewalks and bridge rails, supported by 2ft steel I-beams set on reinforced concrete abutments.

RESOURCE AREA SUMMARY
(See Resource Area Plan)

The Mystic Street Bridge crosses over Mill Brook which is a perennial stream, but is also a major conduit for stormwater flow and collects tributary runoff for a significant portion of the Town. The proposed Mystic Street Bridge Reconstruction Project is located within and/or adjacent to wetland resources areas.

Following a review of the requirements of 310CMR10.00 it is the Engineering Division's opinion that proposed work activity is exempt from the requirements of the Wetland Protection Act as indicated in 310CMR c. 131, § 40.(a) 1. and 2. However, due to the complexity of the project and importance of Mill Brook, a Notice of Intent is being provided to ensure any and all requirements are met and to ensure that *Mill Brook* is not adversely impacted by the proposed work activities.

The following summary is description of the jurisdictional areas under 310CMR10.00 and the proposed work activity proposed within each area:

Jurisdictional areas for the proposed activity are as follows:

310CMR10.00: Statement of Jurisdiction

Section 10.02: Statement of Jurisdiction

(1) Areas Subject to Protection under MGL c.131 § 40

a. Bank; bordering on river
a. Freshwater wetland; bordering on river
b. Land under water
e. Land subject to flooding
f. River Front Area

(1) (a) The work proposed bordering the **"Bank Area"** of Mill Brook includes the required demolition and removal of portions of the existing foundation and abutments to provide room for the installation of new micro-piles, wing walls, pile caps and abutments and the necessary connections to the existing substructure. As part of this work all incidental items including concrete formwork, installation of steel reinforcement, placement of concrete and all structural connections will take place.

Following the removal and installation of the above items, steel I-beams will be installed and connected to the substructure. Installation will include all incidental work including concrete formwork, placement of steel reinforcement, concrete pedestals, utility sleeves and structural connections.

New connections will be made to existing utilities and extension of all utilities will be made to the appropriate utility corridors located between the steel I-beams. Installation will include all incidental work including excavation, pipe work, concrete formwork and placement of concrete and structural connectors.

Installation of existing utilities within the utility corridors and required utility supports will be installed over Mill Brook from one abutment to the opposite abutment. During this, and any phase performing work over Mill Brook the contractor will be required to provide a safety barrier over Mill Brook to prevent items from falling into Mill Brook.

Upon completion of utilities, the reinforced concrete deck will be installed over the bridge span crossing Mill Brook and include concrete form work, installation of reinforcing steel and placement and finishing of concrete. This work will include reinforced concrete sidewalks and installation of bridge rail and supports (for Stage 1 & Stage 3)

(1) (a) A portion of the work referenced above will occur within a **“Freshwater Wetland”** bordering Mill Brook. The same work description above will occur on each side of the bridge adjacent to the sloped bank areas at the entrance and also have a portion of the work located within the delineated bordering vegetated wetland as indicated on the Resource Area Plan.

(1) (b) The work proposed in **“Land under Water”** includes the removal of the existing center support pier under the bridge. Removal of the pier was included in the project scope and evaluated as part of the Hydraulic Report. This activity is proposed to remove the components of the existing bridge infrastructure (center pier) that has historically collected debris and impacted the flow of Mill Brook under the bridge causing flow to back up and flow over the bridge. Removal of the center pier will significantly reduce the chance of debris collecting.

The work proposed to remove the center pier is specified to be removed utilizing a grapple, or cables to minimize disturbance to the bottom of the brook. During this phase of the work, the contractor will be required to install a sediment and turbidity boom don stream of the work to enhance protection of the brook and down-stream flow.

(1) (e) The work proposed in the area **“Land Subject to Flooding”** is the same work description previously indicated on each side of the bridge.

The 100 year Base Flood Elevation (BFE), Zone AE is located adjacent to the proposed work activity and within the bridge channel. The BFE is graphically represented on the Resource Area Delineation plan as indicated on FIRM Map; Community Panel 417E, Map Number 25017C0417E. Effective Date June 4, 2020 and is also characterized as a Floodway Area.

All work is temporary and the grades will be restored to pre-construction conditions. There will be no change to the flood storage volume. Restoration activity including placement of rip-rap and re-vegetating of slope shall mimic grading prior to construction.

(1) (f) The work proposed in the **“Riverfront Area”** is the same work description previously indicated on each side of the bridge. The entire project area is located within the Riverfront Area. See Resource Area Delineation Plan for the limits of the 100 ft River Front Area

As part of the Mystic Street Bridge Reconstruction Project the Contractor will be required to provide and maintain siltation control ("silt sacks") at all catch basins within the work areas. Install erosion control barriers at the limits of work and provide daily street sweeping activities. Protective measures will also be required during specific portions of the project including the installation of a sediment/turbidity boom across Mill Brook down-stream of the work zone provide a protective barrier/screen across Mill Brook during demolition or construction activities y performed over Mill Brook. Lastly, refueling of equipment will be prohibited within the 100-foot Riverfront Area. In addition to contracted Engineering Monitoring and Oversight to be performed by Gill Engineering, the Town of Arlington Engineering Division will oversee the work to ensure that these conditions are met.

Bordering Vegetated Wetland
(See Resource Area Plan)

Review of the resource areas and surface characteristics was performed by the Arlington Engineering Division. Observation included the topographic change indicating the top of bank and edges of Mill Brook as well as evaluation of the plant species and soil characteristics of the areas bordering Mill Brook and the proposed work zone. There was a presence of some wetland species adjacent to the work area, however, upon further investigation, it is the opinion of the Engineering Division that the area is not a jurisdiction bordering vegetated wetland due to the presence of numerous non-wetland plan indicators, including invasive species. However, the area has been indicated on the Resource Area Plan as wetland area and will be provided protection using proper erosion control techniques, minimizing disturbance area and using proper restoration techniques to restore any disturbed conditions. Lastly, the area is located within a designated Special Flood Hazard Area100 year Flood Area Subject to Inundation by Flood (1%); Zone AE as well as a designated Floodway.

The surface and topographic conditions along Mill Brook adjacent to bridge substructure consists of sparse vegetation, rip-rap, boulders, bare ground and concrete. There are four (4) areas with variable conditions as indicated below.

1. On the northern side of the up-stream area adjacent to where Mill Brook flows under bridge there is a landscaped sitting area at the entrance to Cooke's Hollow and there are no indicators of wetland species.

2. On the southern side of the up-stream area adjacent to where Mill Brook flows under bridge there is a vegetated wetland area sloping gradually up from the brook towards the Eversource Substation. There was no evidence of any obligate wetland species. However there were facultative species including:

    - **Herbaceous, groundcover and vines**
        - Multiflora rose; Rosa multiflora (FACU)
        - Japanese Knotweed; Polygonum spp. (invasive)
        - Broadleaf Plantain; Plantago major (FACU)
        - Lizard's Tail; Saururus cernuus (OBG)
        - Trumpet Creeper; Campsis radicans (FAC)
        - Burdock; Arctium minus (???)

    - **Shrubs and understory**
        - Glossy Buckthorn; Rhamnus frangula (FAC)(invasive)
        - Mulberry; Morus rubra (FACU)
        - American Elm; Ulmus americana (FACW-)
        - American Basswood; Tilia americana (FACU)

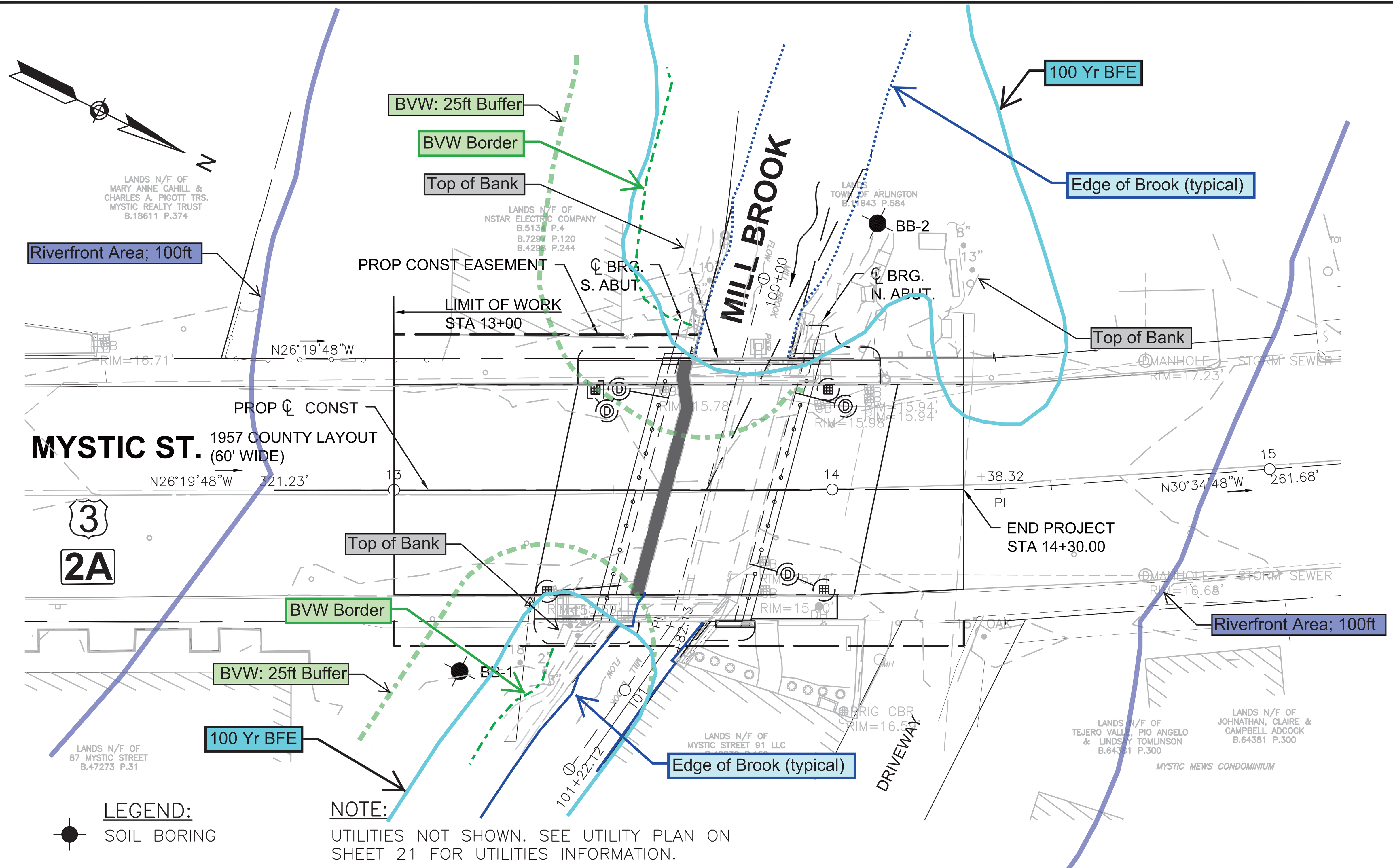
    - **Trees**
        - Catalpa; Catalpa speciose (FAC)
        - Norway Maple; Acer platanoides (invasive)
        - Mulberry; Morus rubra (FACU)
        - White Ash; Fraxinus americana (FACU)

3. On the northern side of the down-stream area adjacent to where Mill Brook flows out from under the bridge consists of concrete walls consisting of a retaining wall and the foundation of the structure located at 91 Mystic Street. Mill Brook flows immediately adjacent to the concrete.

4. On the southern side of the down-stream area adjacent to where Mill Brook flows out from under the bridge there is a sparsely vegetated slope with a slight undercut, sloping gradually up from the brook towards the Armstrong Ambulance building (Address??)
   - **Herbaceous and groundcover**
     - Japanese Knotweed; Polygonum spp. (invasive)
     - Moss; Bryophyta spp. (???)

   - **Shrubs and understory**
     - Mulberry; Morus rubra (FACU)
     - Apple; Malus spp. (???)

   - **Trees**
     - Silver Maple; Acer saccharinum (FACW)
     - Tree of Heaven; Ailanthus altissima (invasive)
     - Red Maple; Acer rubrum (FAC)

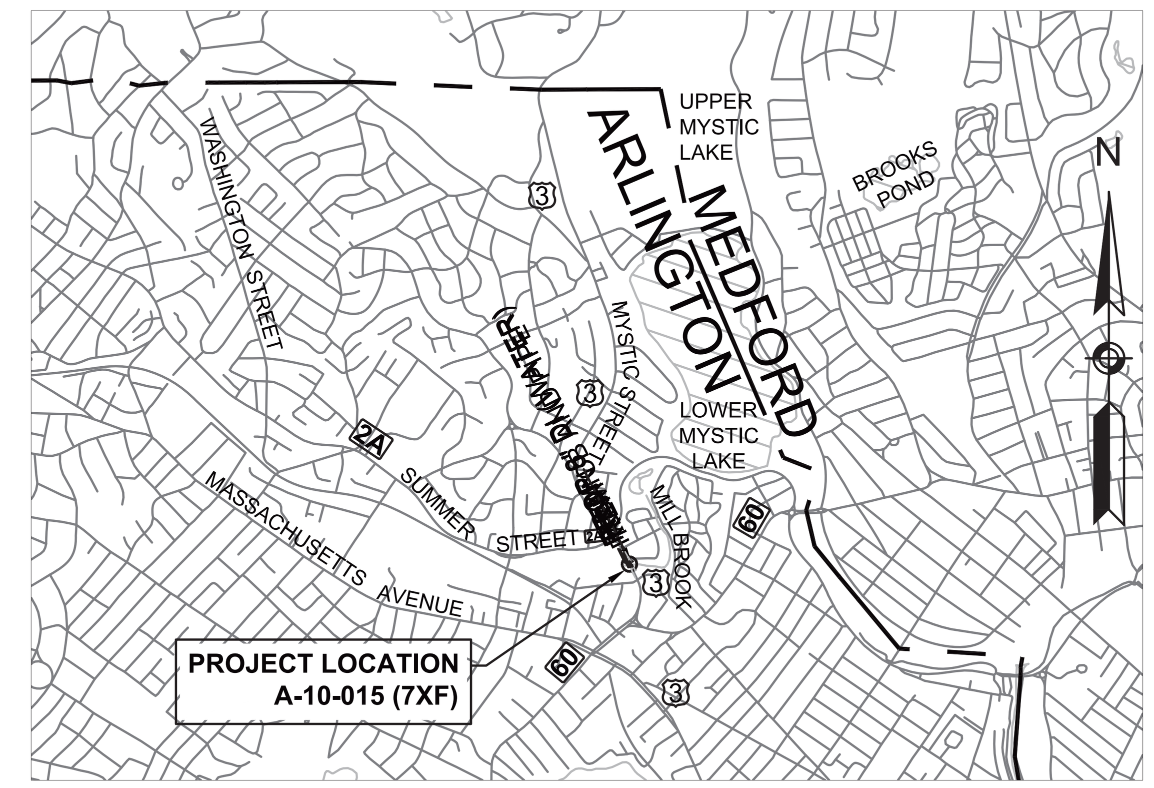


RESOURCE AREA DELINEATION PLAN

Scale: 1" = 20'

RESOURCE AREA SUMMARY

Description	Disturbance
Land Under Water:	100sf (temporary)
BVW Buffer Zone:	125sf (temporary)
Bank Area:	389 sf (temporary)
Flood Zone: AE	22 sf (temporary)

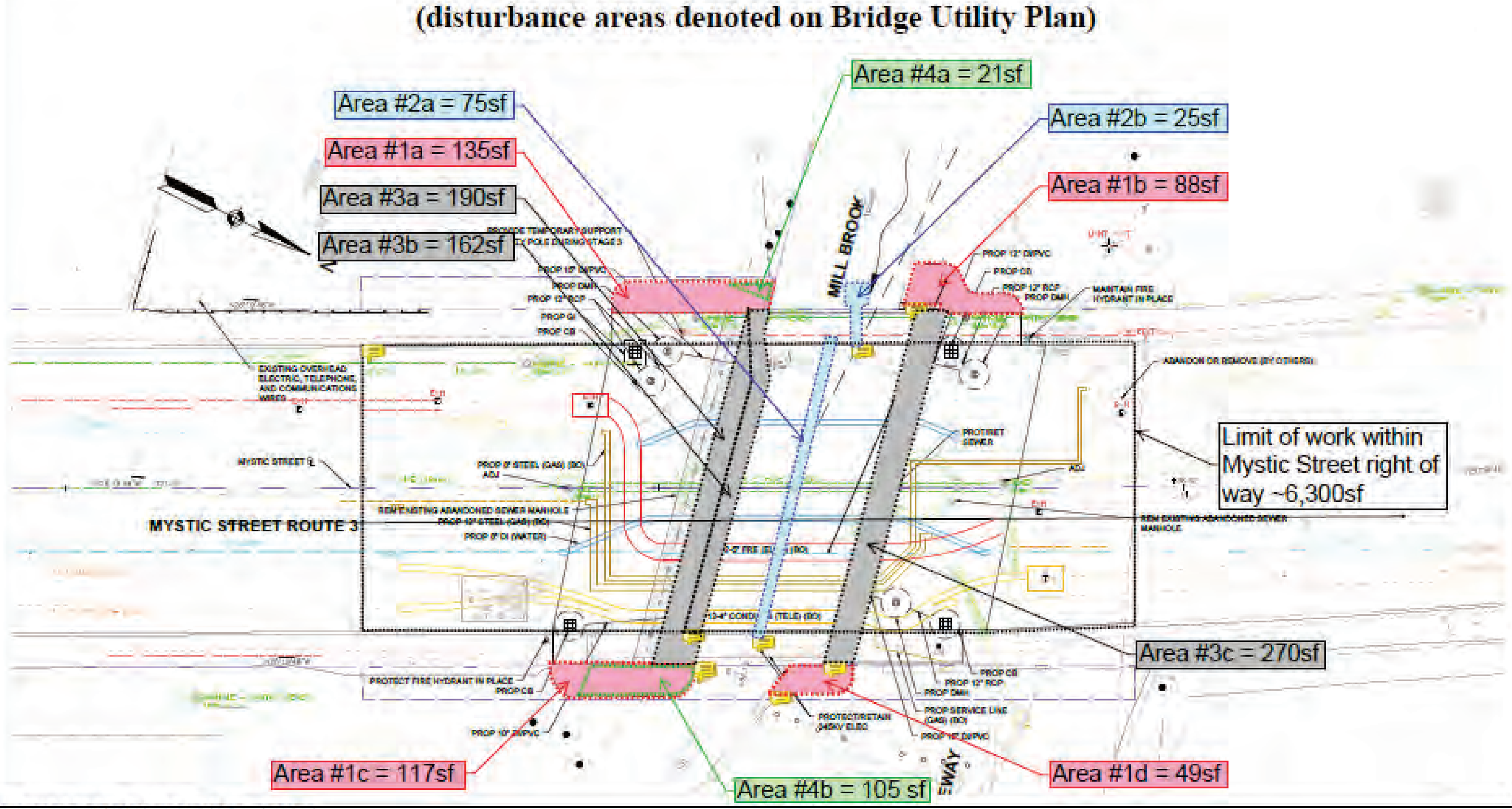


LOCUS

SCALE: 1" = 2000'

WORK WITHIN RESOURCE AREA PLAN

(disturbance areas denoted on Bridge Utility Plan)



WORK IN RESOURCE AREA

Area #1: work within the riverfront area and wetland buffer zone = 389sf; work in this area consists of excavation to install wing walls of abutments and restoration of disturbed area with wetland restoration mix and/or rip-rap.

Area #2: work under water = 100sf; work shall consists of removing existing center piers. Piers and footing to be lifted with grapple and/or chains to minimize disturbance. Excavation method will not be utilized.

Area #3: work within the wetland and river front buffer area = 622sf; work in this area will not cause additional disturbance. Area on top of existing abutments will be capped with concrete top and area behind caps filled with rip-rap.

Area #4: work within a BVW = 126sf (inclusive to Area #1)

CONSERVATION COMMISSION CONDITIONS LIST

CONSERVATION COMMISSION CONDITIONS LIST

PRE-CONSTRUCTPOMION

1. Work permitted by this Order and Permit shall conform to the Notice of Intent, the approved plans and documents (listed above), and oral representations (as recorded in hearing minutes) submitted or made by the Applicant and the Applicant's agents or representatives, as well as any plans and other data, information or representations submitted per these Conditions and approved by the Commission.
2. The provisions of this Order and Permit shall apply to and be binding upon the Applicant and Applicant's assignees, tenants, property management company, employees, contractors, and agents.
3. If there are conflicting conditions within this Order, the stricter condition(s) shall govern.
4. No work shall begin under this Order until: (a) all other required permits or approvals have been obtained and (b) the appeal period of ten (10) business days from the date of issue of this Order has expired without any appeal being filed, and (c) this Order has been recorded in the Registry of Deeds. No work shall be started under this Permit until all other necessary permits or approvals have been obtained.
5. The Applicant shall ensure that a copy of this Order of Conditions and Permit for work, with any referenced plans, is always available on site, and that contractors, site managers, foremen, and sub-contractors understand its provisions.
6. Prior to starting work, the Applicant shall submit to the Commission the names and 24-hour phone numbers of project managers or the persons responsible for site work or mitigation.
7. Before work begins, erosion and sediment controls shall be installed at the limits of the work area or as outlined on the approved plans. These will include a silt fence and a biodegradable 12-inch straw or silt wattle around the entire work area (hay bales are not allowed and silt socks are preferred).
8. Prior to any work commencing, a sign no less than 2 square feet or more than 3 square feet, visible from the street, shall be displayed reading "MA DEP File # _____" and not placed on a living tree.
9. The Applicant shall complete the proposed work during low flow conditions only.
10. The contractor shall contact Conservation Agent; concomm@town.arlington.ma.us;or (781-316-3012) to arrange for a pre-construction meeting with the on-site project manager to walk through the Order of Conditions, confirm the wash out location, and walk the site to confirm the installation and placement of erosion controls prior to the start of any grading or construction work.
11. The contractor shall provide written Notice of the commencement of work start date to the Conservation Agent 48 hours prior to start of work.
12. The Commission, its employees, and its agents shall have the right of entry onto the site to inspect for compliance with the terms of this Order of Conditions and Permit until a Certificate of Compliance has been issued.
13. Any backfill or reuse of on-site materials shall be free of contamination in accordance with the Massachusetts Contingency Plan, 310 CMR 40.0000. All fill used in connection with this project shall be clean borrow. The following shall be prohibited: chemically contaminated material; concrete and asphalt rubble; crushed glass; stumps and other solid waste or anthropogenic materials.

POST-CONSTRUCTION

14. When requesting a Certificate of Compliance for this Order of Conditions, the Applicant must submit a written statement from a Massachusetts professional engineer, registered land surveyor, or registered landscape architect certifying that the completed work complies with the plans referenced in this Order or provide an as-built plan and statement describing any differences.

DUMPSTERS

15. All dumpsters must be covered at the end of each workday, and no dumpsters will be allowed overnight within the 100-foot Buffer Zone or Adjacent Upland Resource Areas ("AURA") or other Resource Areas.

STOCKPILING

16. No uncovered stockpiling of materials shall be permitted overnight within 100 feet of any waterway or water body. Stockpiling shall occur only where noted on approved plans.

EROSION

17. Areas that are disturbed by construction and access activities shall as soon as possible be brought to final grade and reseeded and restabilized and shall be done so prior to the removal of the erosion control barrier. Erosion control measures shall be installed per the approved plans.

EQUIPMENT

18. The Commission and its Agent shall have the discretion to require additional erosion/ siltation control methods during construction if necessary.
19. No heavy equipment may be stored overnight within 50 feet of the wetland and no refueling or maintenance of machinery shall be allowed within the 100-foot Buffer Zone, 200-foot Resource Area, and Adjacent Upland Resource Area or within any Resource Area.
20. Construction entrances shall be used and maintained only where noted on approved plans.
21. Arrangements shall be made for any rinsing of tools, equipment, etc. associated with on -site mixing or use of concrete or other materials such that the wastewater is disposed of in the concrete wash out station-at least 50 feet from the resource area. In no case may waste water be discharged into or onto Resource Areas on or adjacent to the site. In no case may waste water be placed in storm drains. Any spillage of materials shall be cleaned up promptly.

SWEEPING

22. Any dirt or debris spilled or tracked onto any paved streets shall be swept up and removed daily.
23. The areas of construction shall remain in a stable condition at the close of each construction day.

DEWATERING

24. Any dewatering operations shall conform to the following:
    (a) Notify the Conservation Commission that dewatering is required.
    (b) Any catch basins, drains, and outfalls to be used in dewatering operations shall be cleaned out before operations begin.
    (c) Any water discharged as part of any dewatering operation shall be passed through filters, on-site settling basins, settling tank trucks, or other devices to ensure that no observable sediments or pollutants are carried into any Resource Area, street, drain, or adjacent property.
    (d) Measures shall be taken to ensure that no erosion or scouring shall occur on public or private property, or on the banks or bottoms of water bodies, because of dewatering operations.
    (e) Dewatering shall occur only where noted on approved plans.

PLANTINGS

25. Prior to plant installation, the Applicant shall submit planting plan details to the Conservation Commission for approval. Planting details shall include plant sizes, Latin names, regular names, number of plants, and transported method (containerized, balled-and-burlapped, etc.). All plantings shall be native and be installed and maintained according to the standards of the American Association of Nurserymen (AAN). **This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.**
26. The Applicant shall protect all area trees per the Town Wetlands Protection Regulations, Section 24 Vegetation Removal and Replacement, protecting trees through securing (not nailing) 2x4 boards, between 6-8 feet in length, around tree base. The boards shall be installed vertically such that one end is installed directly into the ground. Alternative protection measures must be approved by the Commission or its agent.
27. The Applicant shall replace all removed trees per the Town Wetlands Protection Regulations. Section 24 Vegetation Removal and Replacement.
28. All native restoration plantings shall be maintained for three years, and invasive species removal implemented through this project shall be ongoing for three years. A survival rate of at least 80% must be maintained for the approved restoration plantings. A monitoring report shall be submitted annually in November for the three-year monitoring period and shall include the number and types of restoration plantings evaluated, condition of the plantings, and status of invasive plant removal. The Applicant must provide a monitoring report by a qualified consultant for survival of all approved plantings. The monitoring report must include measures to remove invasive species if they are discovered.

CHEMICALS

29. To avoid adding excess nitrogen runoff, the Applicant shall only treat the lawn area with slow-release nitrogen fertilizer. Application of lawn fertilizer cannot occur in the summer, or after storm events. Lawn fertilizer shall only be applied twice a year, in spring and fall. **This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.**
30. New plantings shall only be fertilized once, during the initial planting year. No pesticides or rodenticides shall be used to treat pest management issues. **This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.**
31. Only the herbicides and herbicide treatment methods stated within the NOI are approved to treat invasive plants. No other herbicides or treatment methods are approved. This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.

PERVIOUS SURFACES

32. Pervious surfaces shown on the project plans shall be maintained and not be replaced by impervious surfaces. This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.
33. Installed permeable surfaces shall be maintained in perpetuity. Prior to construction, the Applicant shall provide an operations and maintenance plan for installed permeable surfaces and, at the discretion of the Commission, a signed copy of a contract for professional maintenance. This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.

STORMWATER

34. The Applicant shall protect all adjacent catch basins using silt socks.
35. The Applicant shall conduct catch basin sump cleanings as necessary to proximate catch basins at the end of the project work period.
36. The project shall not cause an increase in run-off or stormwater volume onto adjacent properties, either during construction or when completed.

DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION
04/01/2021	ABL	ABL	AMS	CHAPTER 85 SUBMISSION

REGISTERED PROFESSIONAL ENGINEER

DATE

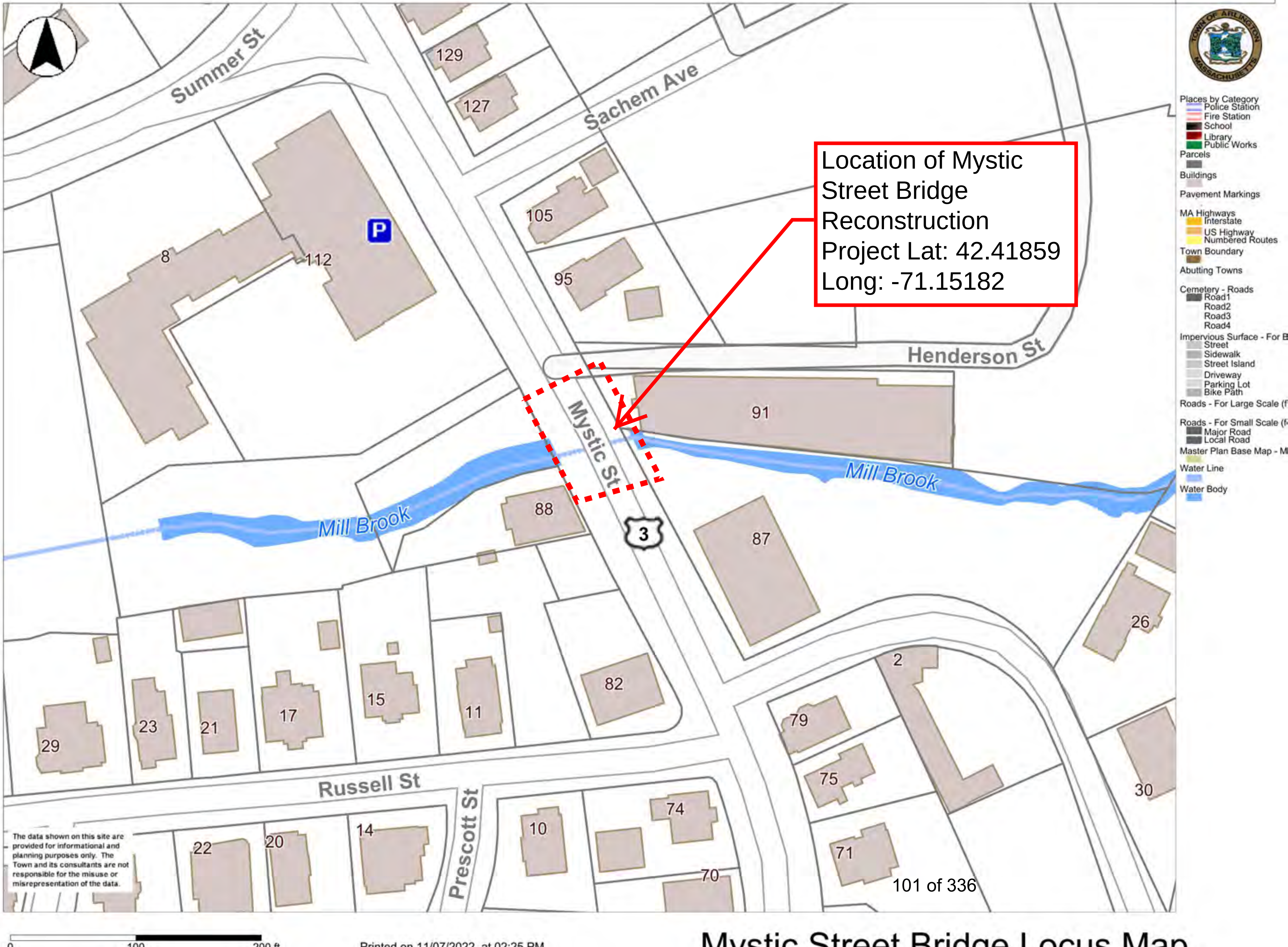
RESOURCE AREA PLAN

Notice of Intent for Mystic Street Bridge Reconstruction Project

Miscellaneous Documents

1. Mystic Street Bridge Reconstruction Project Locus Map
2. Mystic Street Bridge - NOI Abutter Map
3. USGS Topographic Plan - Mystic St. Bridge
4. FEMA Firmette* - Mystic St. Bridge - 2 sheets
5. NHESP Atlas - Arlington
6. Area of Critical Environmental Concern (ACEC)
7. Arlington Block Plan Map 49
8. Arlington Block Plan Map 63
9. Photos; existing conditions

*The FEMA FIRMette notated above shows a portion of the FIRM Map; Community Panel 417E, Map Number 25017C0417E. Effective Date June 4, 2020



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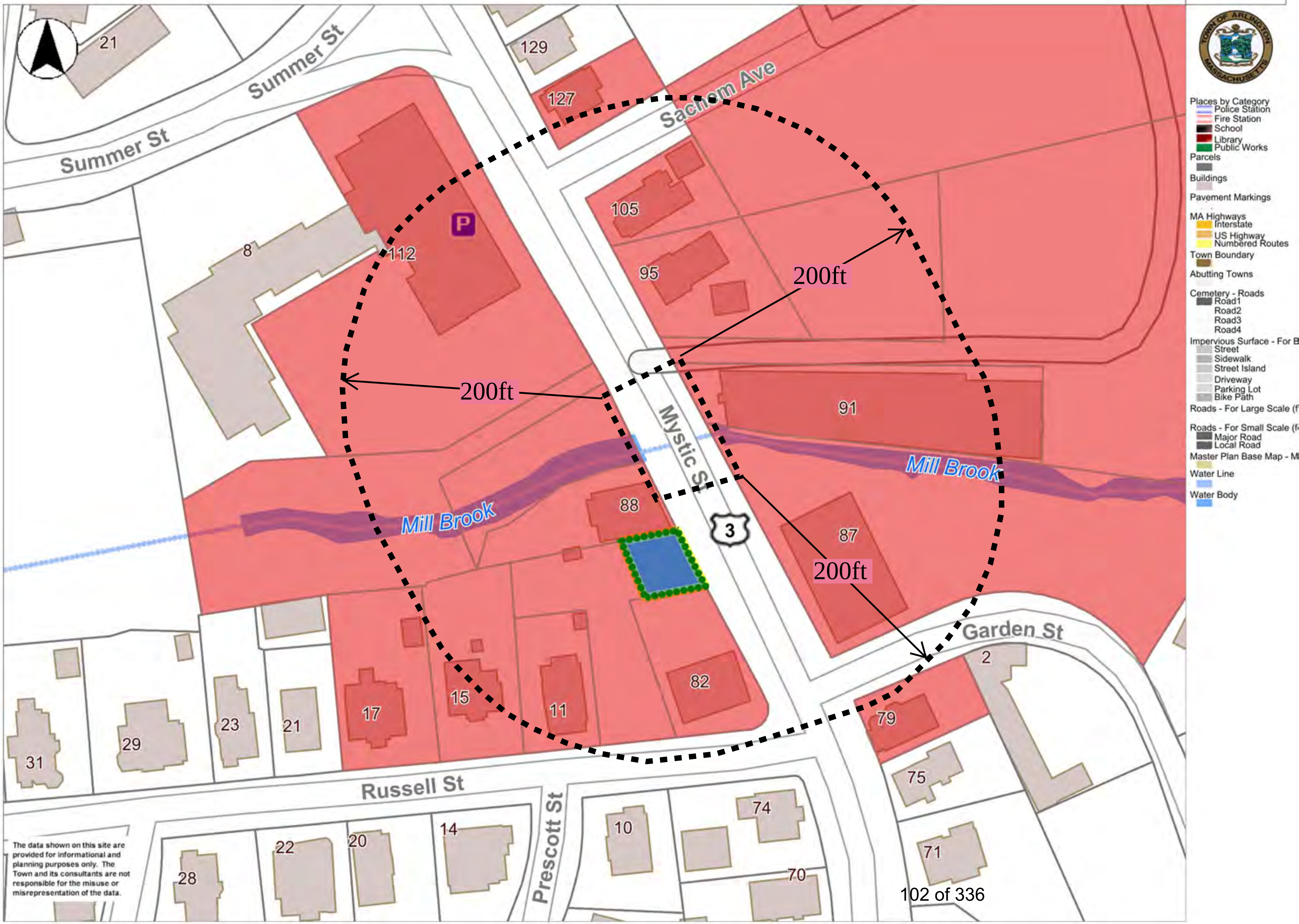
Mystic Street Bridge Locus Map



0 100 200 ft

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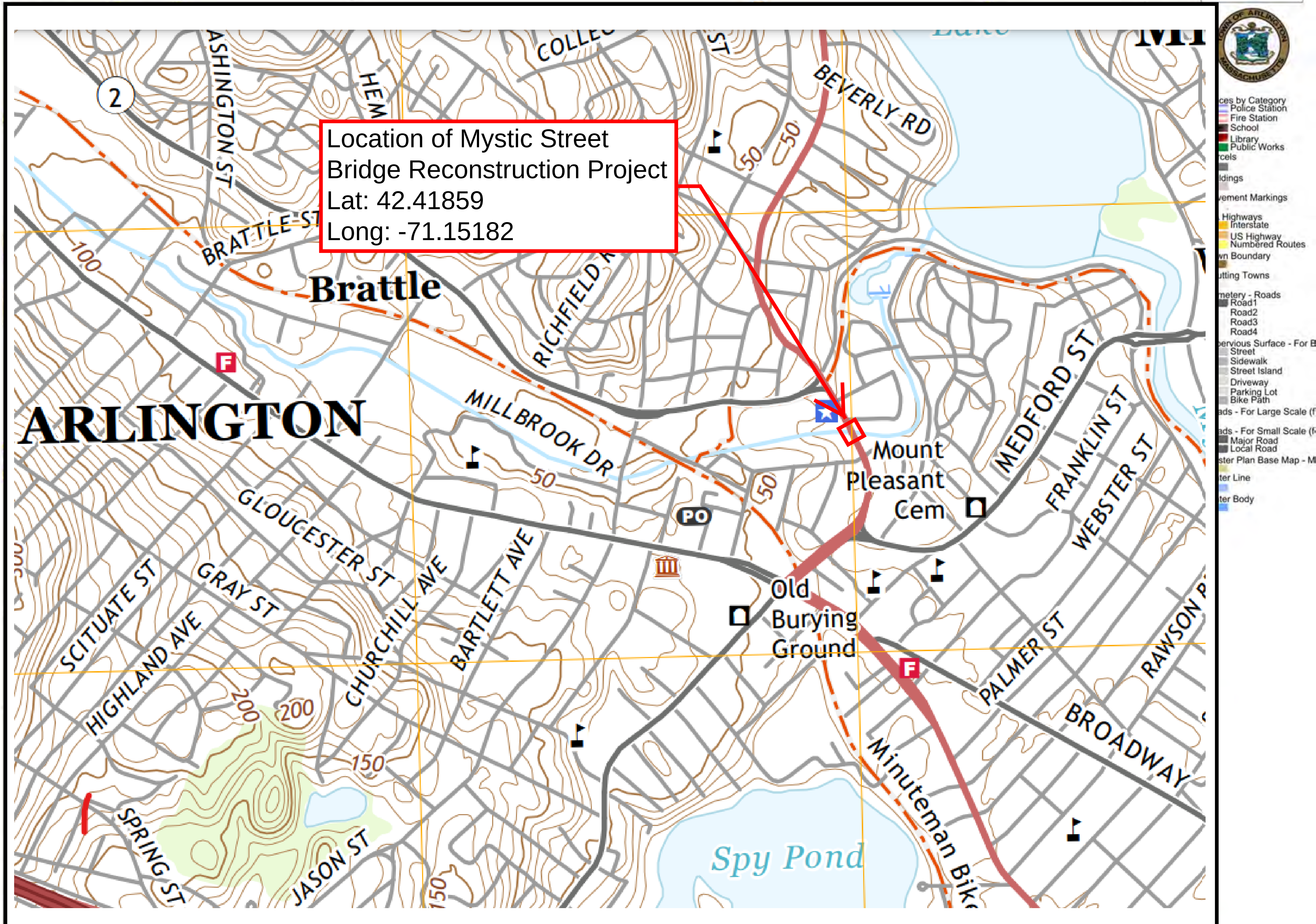
Mystic Street Bridge: Abutter Map

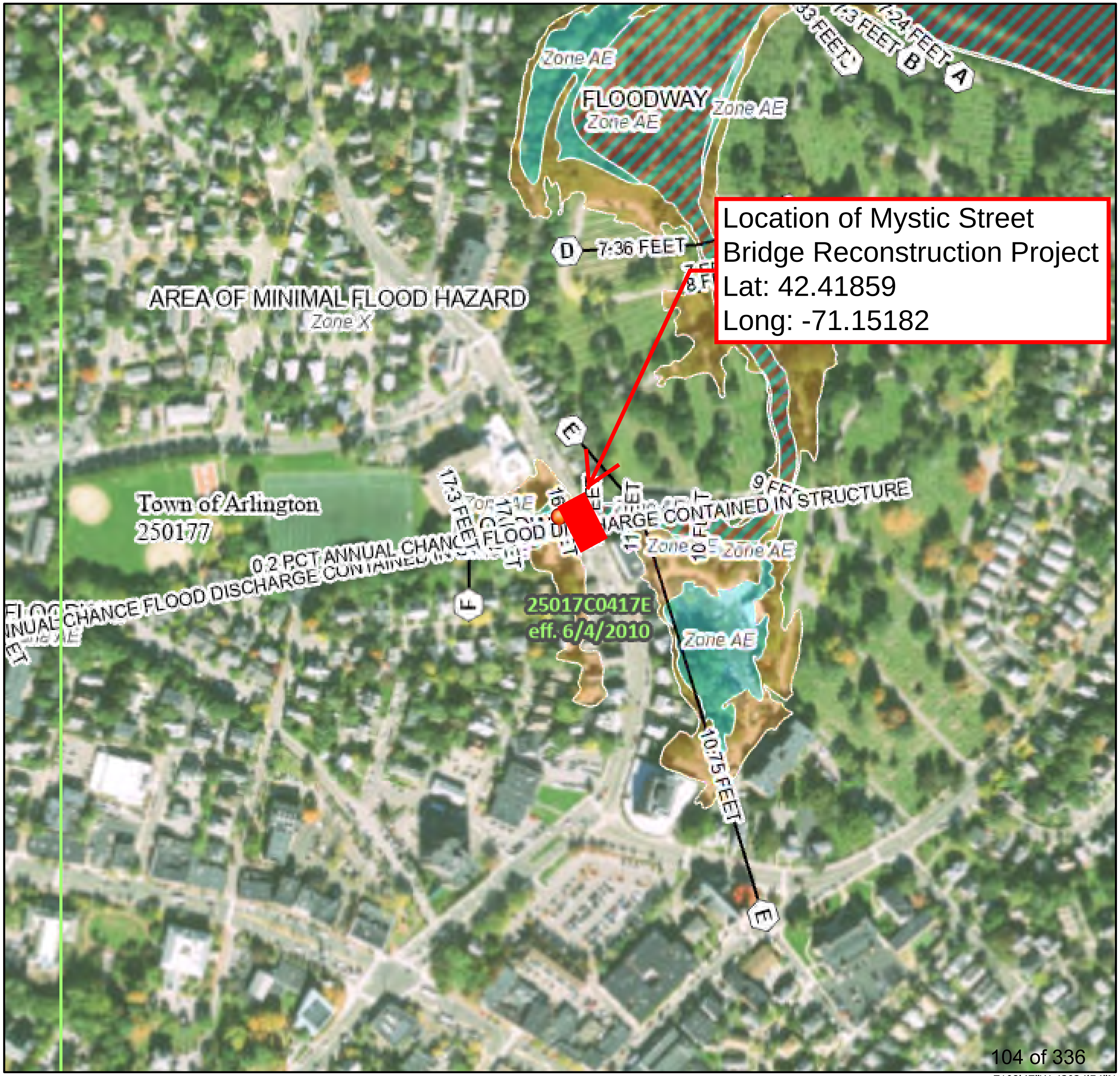


USGS Topographic Map; Mystic Street Bridge

National Flood Hazard Layer FIRMette

FEMA

71°9'24"W 42°25'20"N



71°8'47"W 42°24'54"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

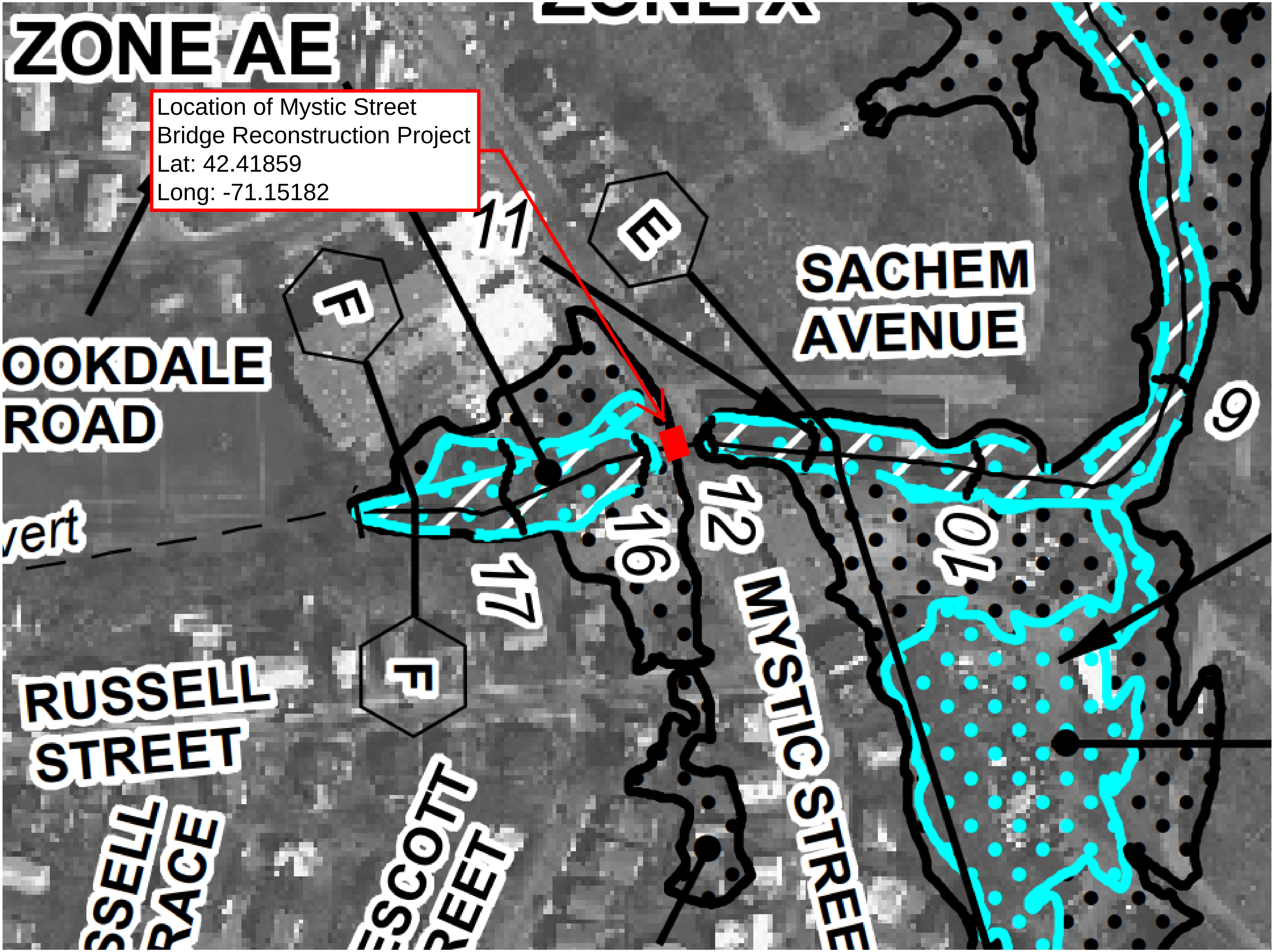
N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

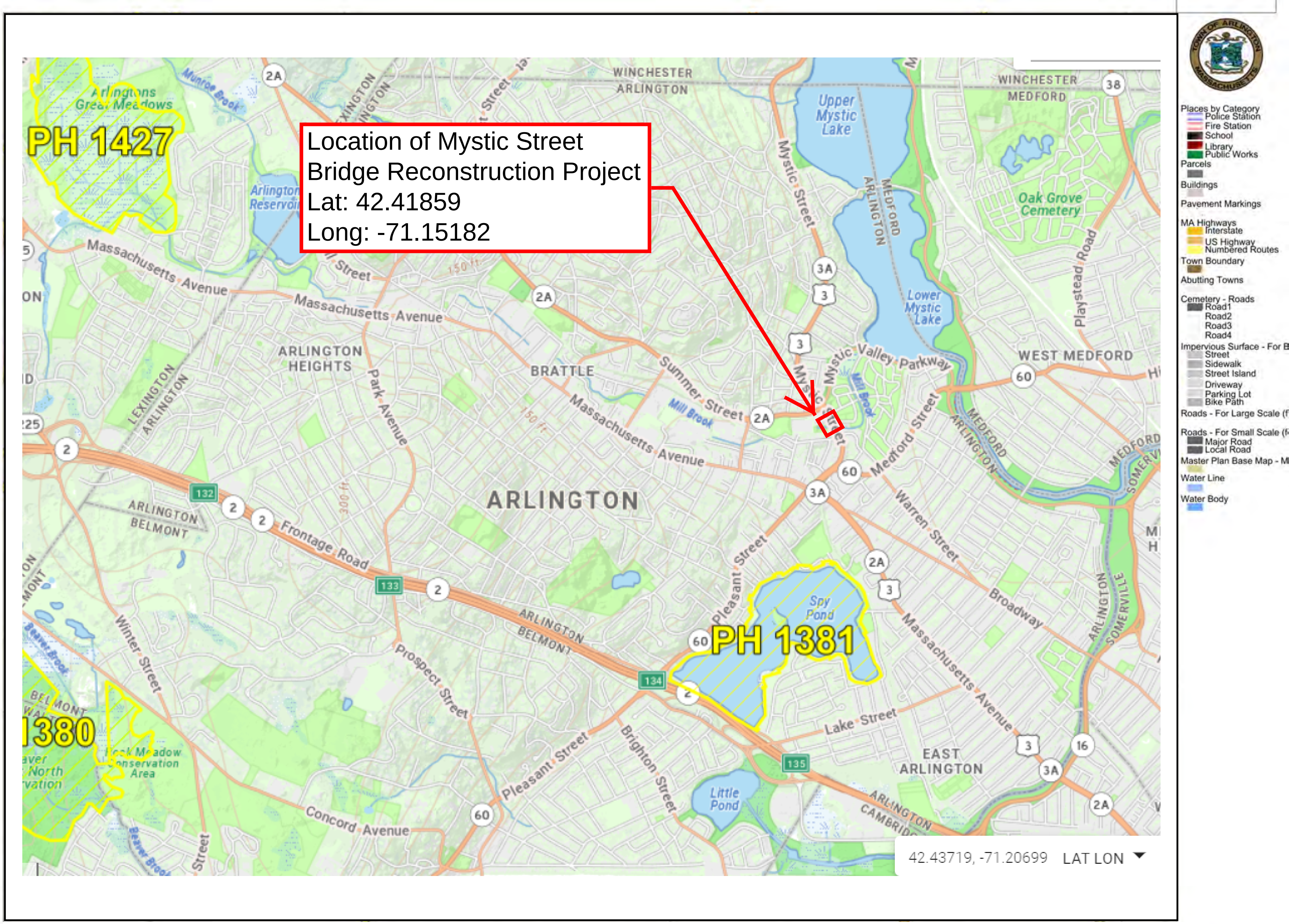
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 9/8/2022 at 11:31 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



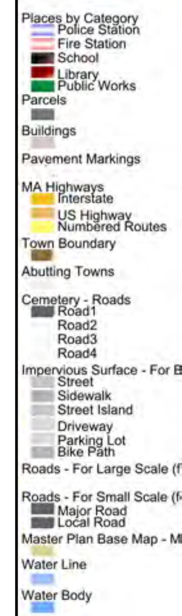
Firm Map Community Panel 25017C0417E - Zoom



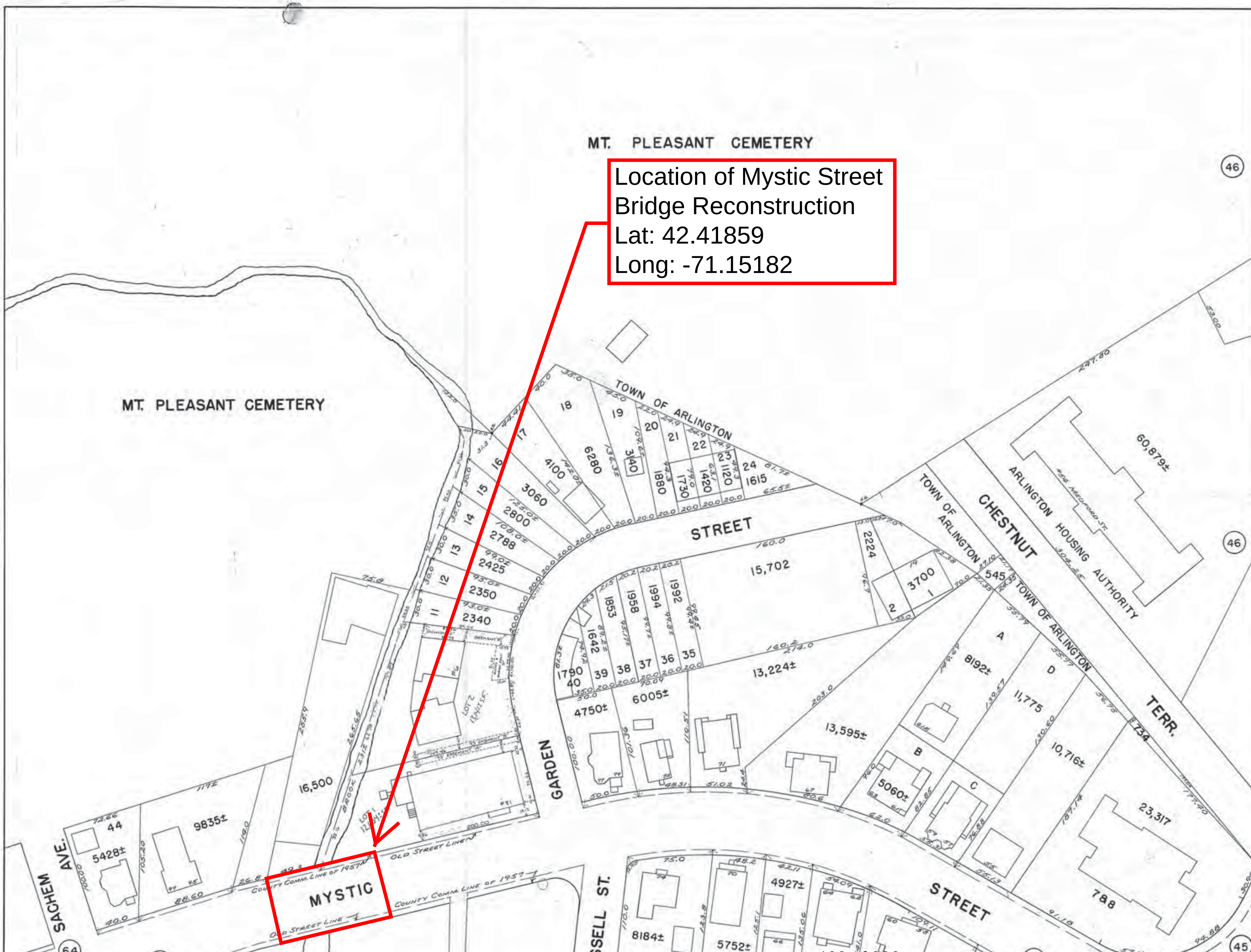
NHESP Estimated & Priority Habitats of Rare Wildlife & Species

ACEC Map
MassGIS 2021 Aerial Imagery

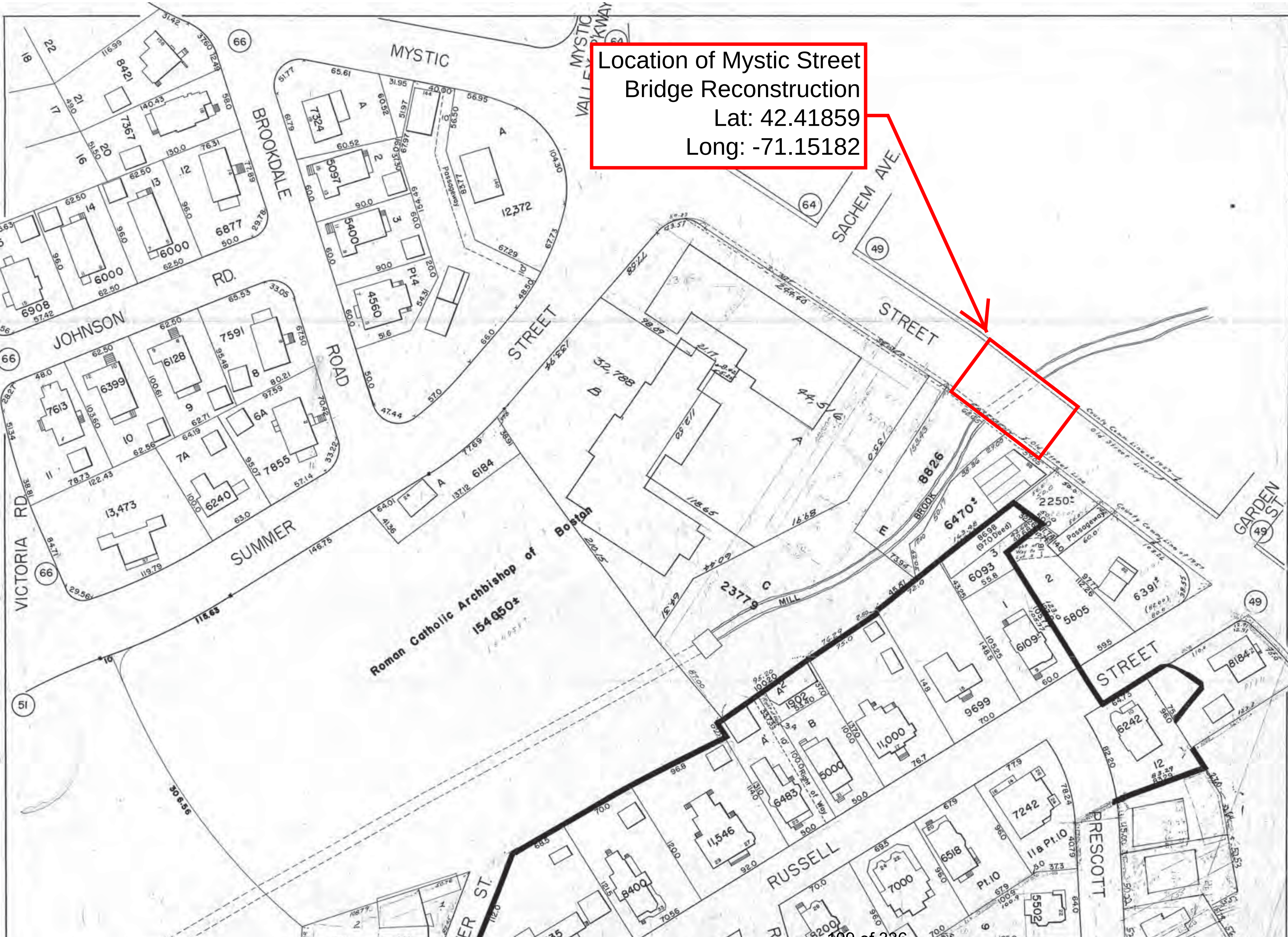
ACEC Map
MassGIS Base Map



Areas of Critical Environmental Concern - ACEC

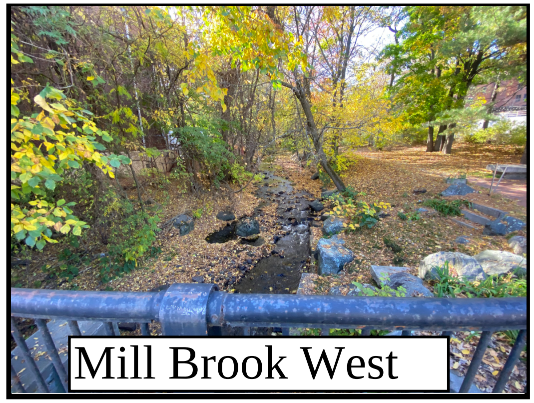


Arlington Block Plan Map - 49



Arlington Block Plan Map - 63


West Abutment


Mill Brook West


Slope at 88 Mystic

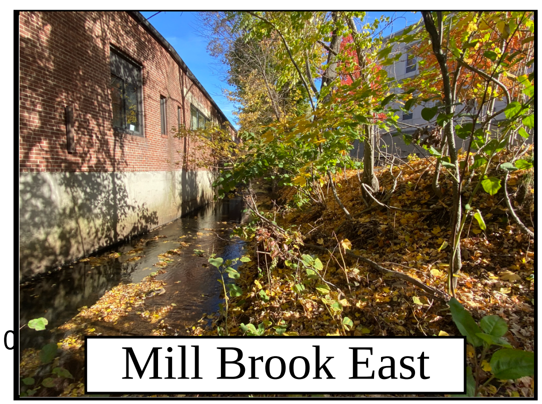

West Abutment & Pier


East Abutment


East Abutment Wall


East Abutment & Pier


East Abutment


Mill Brook East

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Provided by MassDEP:

MassDEP File Number

Document Transaction Number

City/Town

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

Note: Before completing this form consult your local Conservation Commission regarding any municipal bylaw or ordinance.

A. General Information

1. Project Location (**Note:** electronic filers will click on button to locate project site):

Mystic St. at Mill Brook — a. Street Address
Arlington — b. City/Town
02476 — c. Zip Code

Latitude and Longitude:
42.41859 — d. Latitude
-71.15182 — e. Longitude

Block Plan 49 & 63 Lat: 42.41859
Long: -71.15182
NA — g. Parcel /Lot Number

2. Applicant:

Wayne — a. First Name
Chouinard — b. Last Name
Arlington Department of Public Works; Engineering Division — c. Organization
51 Grove Street — d. Street Address
Arlington — e. City/Town
MA — f. State
02476 — g. Zip Code
781-316-3320 — h. Phone Number
781-316-3318 — i. Fax Number
wchouinard@town.arlington.ma.us — j. Email Address

3. Property owner (required if different from applicant): ☐ Check if more than one owner

a. First Name
b. Last Name
Town of Arlington — c. Organization
730 Mass Ave. — d. Street Address
Arlington — e. City/Town
MA — f. State
02476 — g. Zip Code
h. Phone Number
i. Fax Number
j. Email address

4. Representative (if any):

Wayne — a. First Name
Chouinard — b. Last Name
Arlington Department of Public Works; Engineering Division — c. Company
51 Grove Street — d. Street Address
Arlington — e. City/Town
MA — f. State
02476 — g. Zip Code
781-316-3320 — h. Phone Number
781-316-3318 — i. Fax Number
wchouinard@town.arlington.ma.us — j. Email address

5. Total WPA Fee Paid (from NOI Wetland Fee Transmittal Form):

- 0 - — a. Total Fee Paid
- 0 - — b. State Fee Paid
- 0 - — c. City/Town Fee Paid

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A. General Information (continued)

6. General Project Description:

   Reconstruction of Mystic Street Bridge located over Mill Brook. Bridge inspections have revealed cracks within granite girders spanning the existing span over Mill Brook. Current project will replace the existing bridge originally constructed around 1850 per MassDOT and widened in 1958.

7a. Project Type Checklist: (Limited Project Types see Section A. 7b.)

1. ☐ Single Family Home
2. ☐ Residential Subdivision
3. ☐ Commercial/Industrial
4. ☐ Dock/Pier
5. ☐ Utilities
6. ☐ Coastal engineering Structure
7. ☐ Agriculture (e.g., cranberries, forestry)
8. ☐ Transportation
9. ☒ Other

7b. Is any portion of the proposed activity eligible to be treated as a limited project (including Ecological Restoration Limited Project) subject to 310 CMR 10.24 (coastal) or 310 CMR 10.53 (inland)?

1. ☒ Yes ☐ No

If yes, describe which limited project applies to this project. (See 310 CMR 10.24 and 10.53 for a complete list and description of limited project types)

10.53(i) maintenance, repair & improvement of structures including …headwalls, bridges, and culverts, and appurtenantally 10.53(d) for underground utilities incorporated into the bridge design.

If the proposed activity is eligible to be treated as an Ecological Restoration Limited Project (310 CMR10.24(8), 310 CMR 10.53(4)), complete and attach Appendix A: Ecological Restoration Limited Project Checklist and Signed Certification.

8. Property recorded at the Registry of Deeds for:

   NA
   a. County

   b. Certificate # (if registered land)

   c. Book

   d. Page Number

B. Buffer Zone & Resource Area Impacts (temporary & permanent)

1. ☐ Buffer Zone Only – Check if the project is located only in the Buffer Zone of a Bordering Vegetated Wetland, Inland Bank, or Coastal Resource Area.
2. ☒ Inland Resource Areas (see 310 CMR 10.54-10.58; if not applicable, go to Section B.3, Coastal Resource Areas).

Check all that apply below. Attach narrative and any supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

For all projects affecting other Resource Areas, please attach a narrative explaining how the resource area was delineated.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☒ Bank	- 0 - 1. linear feet	2. linear feet
b. ☒ Bordering Vegetated Wetland	- 126 - 1. square feet	2. square feet
c. ☒ Land Under Waterbodies and Waterways	- 100 sf - 1. square feet	2. square feet
	- 0 - 3. cubic yards dredged	

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
d. ☐ Bordering Land Subject to Flooding	- 0 - 1. square feet	2. square feet
	- 0 - 3. cubic feet of flood storage lost	4. cubic feet replaced
e. ☐ Isolated Land Subject to Flooding	NA 1. square feet	
	2. cubic feet of flood storage lost	3. cubic feet replaced
f. ☒ Riverfront Area	Mill Brook (inland) 1. Name of Waterway (if available) - **specify coastal or inland**	

2. Width of Riverfront Area (check one):

   ☐ 25 ft. - Designated Densely Developed Areas only

   ☐ 100 ft. - New agricultural projects only

   ☒ 200 ft. - All other projects

3. Total area of Riverfront Area on the site of the proposed project: - 6,300 - square feet

4. Proposed alteration of the Riverfront Area:

- 389 -	- 389 -	- 0 -
a. total square feet	b. square feet within 100 ft.	c. square feet between 100 ft. and 200 ft.

5. Has an alternatives analysis been done and is it attached to this NOI? ☐ Yes ☐ No

6. Was the lot where the activity is proposed created prior to August 1, 1996? ☒ Yes ☐ No

3. ☐ Coastal Resource Areas: (See 310 CMR 10.25-10.35)

Note: for coastal riverfront areas, please complete **Section B.2.f**. above.

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MassDEP File Number

Document Transaction Number

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B. Buffer Zone & Resource Area Impacts (temporary & permanent) (cont'd)

Check all that apply below. Attach narrative and supporting documentation describing how the project will meet all performance standards for each of the resource areas altered, including standards requiring consideration of alternative project design or location.

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

Resource Area	Size of Proposed Alteration	Proposed Replacement (if any)
a. ☐ Designated Port Areas	Indicate size under Land Under the Ocean, below	
b. ☐ Land Under the Ocean	1. square feet 2. cubic yards dredged	
c. ☐ Barrier Beach	Indicate size under Coastal Beaches and/or Coastal Dunes below	
d. ☐ Coastal Beaches	1. square feet	2. cubic yards beach nourishment
e. ☐ Coastal Dunes	1. square feet	2. cubic yards dune nourishment

	Size of Proposed Alteration	Proposed Replacement (if any)
f. ☐ Coastal Banks	1. linear feet	
g. ☐ Rocky Intertidal Shores	1. square feet	
h. ☐ Salt Marshes	1. square feet	2. sq ft restoration, rehab., creation
i. ☐ Land Under Salt Ponds	1. square feet 2. cubic yards dredged	
j. ☐ Land Containing Shellfish	1. square feet	
k. ☐ Fish Runs	Indicate size under Coastal Banks, inland Bank, Land Under the Ocean, and/or inland Land Under Waterbodies and Waterways, above 1. cubic yards dredged	
l. ☐ Land Subject to Coastal Storm Flowage	1. square feet	

4. ☐ Restoration/Enhancement
If the project is for the purpose of restoring or enhancing a wetland resource area in addition to the square footage that has been entered in Section B.2.b or B.3.h above, please enter the additional amount here.

a. square feet of BVW

b. square feet of Salt Marsh

5. ☐ Project Involves Stream Crossings

a. number of new stream crossings

b. number of replacement stream crossings

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Provided by MassDEP:

MassDEP File Number

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C. Other Applicable Standards and Requirements

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section C and complete Appendix A: Ecological Restoration Limited Project Checklists – Required Actions (310 CMR 10.11).

Streamlined Massachusetts Endangered Species Act/Wetlands Protection Act Review

1. Is any portion of the proposed project located in **Estimated Habitat of Rare Wildlife** as indicated on the most recent Estimated Habitat Map of State-Listed Rare Wetland Wildlife published by the Natural Heritage and Endangered Species Program (NHESP)? To view habitat maps, see the *Massachusetts Natural Heritage Atlas* or go to http://maps.massgis.state.ma.us/PRI_EST_HAB/viewer.htm.

a. ☐ Yes ☒ No

If yes, include proof of mailing or hand delivery of NOI to:

Natural Heritage and Endangered Species Program
Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581

2017
b. Date of map

If *yes*, the project is also subject to Massachusetts Endangered Species Act (MESA) review (321 CMR 10.18). To qualify for a streamlined, 30-day, MESA/Wetlands Protection Act review, please complete Section C.1.c, and include requested materials with this Notice of Intent (NOI); *OR* complete Section C.2.f, if applicable. *If MESA supplemental information is not included with the NOI, by completing Section 1 of this form, the NHESP will require a separate MESA filing which may take up to 90 days to review (unless noted exceptions in Section 2 apply, see below).*

c. Submit Supplemental Information for Endangered Species Review*

1. ☐ Percentage/acreage of property to be altered:

(a) within wetland Resource Area ______ percentage/acreage

(b) outside Resource Area ______ percentage/acreage

2. ☐ Assessor's Map or right-of-way plan of site

2. ☒ Project plans for entire project site, including wetland resource areas and areas outside of wetlands jurisdiction, showing existing and proposed conditions, existing and proposed tree/vegetation clearing line, and clearly demarcated limits of work **

(a) ☒ Project description (including description of impacts outside of wetland resource area & buffer zone)

(b) ☒ Photographs representative of the site

* Some projects **not** in Estimated Habitat may be located in Priority Habitat, and require NHESP review (see https://www.mass.gov/ma-endangered-species-act-mesa-regulatory-review).
Priority Habitat includes habitat for state-listed plants and strictly upland species not protected by the Wetlands Protection Act.
** MESA projects may not be segmented (321 CMR 10.16). The applicant must disclose full development plans even if such plans are not required as part of the Notice of Intent process.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands
WPA Form 3 – Notice of Intent
Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Provided by MassDEP:

MassDEP File Number

Document Transaction Number

City/Town

C. Other Applicable Standards and Requirements (cont'd)

(c) ☐ MESA filing fee (fee information available at https://www.mass.gov/how-to/how-to-file-for-a-mesa-project-review).
Make check payable to "Commonwealth of Massachusetts - NHESP" and ***mail to NHESP*** at above address

*Projects altering **10 or more acres** of land, also submit:*

(d) ☐ Vegetation cover type map of site

(e) ☐ Project plans showing Priority & Estimated Habitat boundaries

(f) OR Check One of the Following

1. ☐ Project is exempt from MESA review.
Attach applicant letter indicating which MESA exemption applies. (See 321 CMR 10.14, https://www.mass.gov/service-details/exemptions-from-review-for-projectsactivities-in-priority-habitat; the NOI must still be sent to NHESP if the project is within estimated habitat pursuant to 310 CMR 10.37 and 10.59.)

2. ☐ Separate MESA review ongoing.

a. NHESP Tracking #

b. Date submitted to NHESP

3. ☐ Separate MESA review completed.
Include copy of NHESP "no Take" determination or valid Conservation & Management Permit with approved plan.

3. For coastal projects only, is any portion of the proposed project located below the mean high water line or in a fish run?

a. ☐ Not applicable – project is in inland resource area only b. ☐ Yes ☐ No

If yes, include proof of mailing, hand delivery, or electronic delivery of NOI to either:

South Shore - Cohasset to Rhode Island border, and the Cape & Islands:

Division of Marine Fisheries -
Southeast Marine Fisheries Station
Attn: Environmental Reviewer
836 South Rodney French Blvd.
New Bedford, MA 02744
Email: dmf.envreview-south@mass.gov

North Shore - Hull to New Hampshire border:

Division of Marine Fisheries -
North Shore Office
Attn: Environmental Reviewer
30 Emerson Avenue
Gloucester, MA 01930
Email: dmf.envreview-north@mass.gov

Also if yes, the project may require a Chapter 91 license. For coastal towns in the Northeast Region, please contact MassDEP's Boston Office. For coastal towns in the Southeast Region, please contact MassDEP's Southeast Regional Office.

c. ☐ Is this an aquaculture project? d. ☐ Yes ☐ No

If yes, include a copy of the Division of Marine Fisheries Certification Letter (M.G.L. c. 130, § 57).

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Provided by MassDEP:

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City/Town

C. Other Applicable Standards and Requirements (cont'd)

Online Users: Include your document transaction number (provided on your receipt page) with all supplementary information you submit to the Department.

4. Is any portion of the proposed project within an Area of Critical Environmental Concern (ACEC)?

   a. ☐ Yes ☒ No If yes, provide name of ACEC (see instructions to WPA Form 3 or MassDEP Website for ACEC locations). **Note:** electronic filers click on Website.

   b. ACEC

5. Is any portion of the proposed project within an area designated as an Outstanding Resource Water (ORW) as designated in the Massachusetts Surface Water Quality Standards, 314 CMR 4.00?

   a. ☐ Yes ☒ No

6. Is any portion of the site subject to a Wetlands Restriction Order under the Inland Wetlands Restriction Act (M.G.L. c. 131, § 40A) or the Coastal Wetlands Restriction Act (M.G.L. c. 130, § 105)?

   a. ☐ Yes ☒ No

7. Is this project subject to provisions of the MassDEP Stormwater Management Standards?

   a. ☐ Yes. Attach a copy of the Stormwater Report as required by the Stormwater Management Standards per 310 CMR 10.05(6)(k)-(q) and check if:

      1. ☐ Applying for Low Impact Development (LID) site design credits (as described in Stormwater Management Handbook Vol. 2, Chapter 3)

      2. ☐ A portion of the site constitutes redevelopment

      3. ☐ Proprietary BMPs are included in the Stormwater Management System.

   b. ☒ No. Check why the project is exempt:

      1. ☐ Single-family house

      2. ☒ Emergency road repair

      3. ☐ Small Residential Subdivision (less than or equal to 4 single-family houses or less than or equal to 4 units in multi-family housing project) with no discharge to Critical Areas.

D. Additional Information

☐ This is a proposal for an Ecological Restoration Limited Project. Skip Section D and complete Appendix A: Ecological Restoration Notice of Intent – Minimum Required Documents (310 CMR 10.12).

Applicants must include the following with this Notice of Intent (NOI). See instructions for details.

Online Users: Attach the document transaction number (provided on your receipt page) for any of the following information you submit to the Department.

1. ☐ USGS or other map of the area (along with a narrative description, if necessary) containing sufficient information for the Conservation Commission and the Department to locate the site. (Electronic filers may omit this item.)

2. ☐ Plans identifying the location of proposed activities (including activities proposed to serve as a Bordering Vegetated Wetland [BVW] replication area or other mitigating measure) relative to the boundaries of each affected resource area.

Massachusetts Department of Environmental Protection
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Provided by MassDEP:

MassDEP File Number

Document Transaction Number

City/Town

D. Additional Information (cont'd)

3. ☒ Identify the method for BVW and other resource area boundary delineations (MassDEP BVW Field Data Form(s), Determination of Applicability, Order of Resource Area Delineation, etc.), and attach documentation of the methodology.

4. ☒ List the titles and dates for all plans and other materials submitted with this NOI.

See attached
a. Plan Title

b. Prepared By

c. Signed and Stamped by

d. Final Revision Date

e. Scale

f. Additional Plan or Document Title

g. Date

5. ☐ If there is more than one property owner, please attach a list of these property owners not listed on this form.

6. ☐ Attach proof of mailing for Natural Heritage and Endangered Species Program, if needed.

7. ☐ Attach proof of mailing for Massachusetts Division of Marine Fisheries, if needed.

8. ☐ Attach NOI Wetland Fee Transmittal Form

9. ☐ Attach Stormwater Report, if needed.

E. Fees

1. ☒ Fee Exempt: No filing fee shall be assessed for projects of any city, town, county, or district of the Commonwealth, federally recognized Indian tribe housing authority, municipal housing authority, or the Massachusetts Bay Transportation Authority.

Applicants must submit the following information (in addition to pages 1 and 2 of the NOI Wetland Fee Transmittal Form) to confirm fee payment:

2. Municipal Check Number

3. Check date

4. State Check Number

5. Check date

6. Payor name on check: First Name

7. Payor name on check: Last Name

Massachusetts Department of Environmental Protection
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Provided by MassDEP:

MassDEP File Number

Document Transaction Number

City/Town

F. Signatures and Submittal Requirements

I hereby certify under the penalties of perjury that the foregoing Notice of Intent and accompanying plans, documents, and supporting data are true and complete to the best of my knowledge. I understand that the Conservation Commission will place notification of this Notice in a local newspaper at the expense of the applicant in accordance with the wetlands regulations, 310 CMR 10.05(5)(a).

I further certify under penalties of perjury that all abutters were notified of this application, pursuant to the requirements of M.G.L. c. 131, § 40. Notice must be made by Certificate of Mailing or in writing by hand delivery or certified mail (return receipt requested) to all abutters within 100 feet of the property line of the project location.

1. Signature of Applicant — (as DPW Town Engineer)
2. Date: 11/09/2022

3. Signature of Property Owner (if different)
4. Date: 11/09/2022

5. Signature of Representative (if any)
6. Date

For Conservation Commission:
Two copies of the completed Notice of Intent (Form 3), including supporting plans and documents, two copies of the NOI Wetland Fee Transmittal Form, and the city/town fee payment, to the Conservation Commission by certified mail or hand delivery.

For MassDEP:
One copy of the completed Notice of Intent (Form 3), including supporting plans and documents, one copy of the NOI Wetland Fee Transmittal Form, and a **copy** of the state fee payment to the MassDEP Regional Office (see Instructions) by certified mail or hand delivery.

Other:
If the applicant has checked the “yes” box in any part of Section C, Item 3, above, refer to that section and the Instructions for additional submittal requirements.

The original and copies must be sent simultaneously. Failure by the applicant to send copies in a timely manner may result in dismissal of the Notice of Intent.

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Wetlands

NOI Wetland Fee Transmittal Form

Massachusetts Wetlands Protection Act M.G.L. c. 131, §40

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Applicant Information

1. Location of Project:

Mystic Street Bridge over Mill Brook
a. Street Address

Arlington MA
b. City/Town

NA
c. Check number

NA
d. Fee amount

2. Applicant Mailing Address:

Wayne
a. First Name

Chouinard
b. Last Name

Department of Public Works
c. Organization

51 Grove Street
d. Mailing Address

Arlington
e. City/Town

MA
f. State

02476
g. Zip Code

781-316-3320
h. Phone Number

781-316-3318
i. Fax Number

wchouinard@town.arlingotn.ma.us
j. Email Address

3. Property Owner (if different):

Town of Arlington
a. First Name

b. Last Name

Town of Arlington
c. Organization

Town Hall - Town Manager's Office
d. Mailing Address

Arlington
e. City/Town

MA
f. State

02476
g. Zip Code

781-316-3004
h. Phone Number

i. Fax Number

kdefrancisco@town.arlington.ma.us
j. Email Address

B. Fees

To calculate filing fees, refer to the category fee list and examples in the instructions for filling out WPA Form 3 (Notice of Intent).

Fee should be calculated using the following process & worksheet. ***Please see Instructions before filling out worksheet.***

Step 1/Type of Activity: Describe each type of activity that will occur in wetland resource area and buffer zone.

Step 2/Number of Activities: Identify the number of each type of activity.

Step 3/Individual Activity Fee: Identify each activity fee from the six project categories listed in the instructions.

Step 4/Subtotal Activity Fee: Multiply the number of activities (identified in Step 2) times the fee per category (identified in Step 3) to reach a subtotal fee amount. Note: If any of these activities are in a Riverfront Area in addition to another Resource Area or the Buffer Zone, the fee per activity should be multiplied by 1.5 and then added to the subtotal amount.

Step 5/Total Project Fee: Determine the total project fee by adding the subtotal amounts from Step 4.

Step 6/Fee Payments: To calculate the state share of the fee, divide the total fee in half and subtract $12.50. To calculate the city/town share of the fee, divide the total fee in half and add $12.50.

B. Fees (continued)

Step 1/Type of Activity	Step 2/Number of Activities	Step 3/Individual Activity Fee	Step 4/Subtotal Activity Fee
Fee Exempt for Municipality			

Step 5/Total Project Fee: - 0 -

Step 6/Fee Payments:

Total Project Fee: ____________
a. Total Fee from Step 5

State share of filing Fee: ____________
b. 1/2 Total Fee **less $**12.50

City/Town share of filling Fee: ____________
c. 1/2 Total Fee **plus** $12.50

C. Submittal Requirements

a.) Complete pages 1 and 2 and send with a check or money order for the state share of the fee, payable to the Commonwealth of Massachusetts.

Department of Environmental Protection
Box 4062
Boston, MA 02211

b.) **To the Conservation Commission:** Send the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and the city/town fee payment.

To MassDEP Regional Office (see Instructions): Send a copy of the Notice of Intent or Abbreviated Notice of Intent; a **copy** of this form; and a **copy** of the state fee payment. (E-filers of Notices of Intent may submit these electronically.)

ABUTTER NOTIFICATION

Notification to Abutters Under the
Massachusetts Wetlands Protection Act
And Arlington Wetlands Protection Bylaw

In accordance with the second paragraph of Massachusetts General Laws Chapter 131, Section 40, and the Arlington Wetlands Protection Bylaw, you are hereby notified of the following:

The Conservation Commission will hold a public hearing in the second floor conference room of the Town Hall Annex, 730 Massachusetts Avenue, Arlington, on **Thursday, November 17th, 2022**, at **7:00 P.M.** in accordance with the provisions of the Massachusetts Wetlands Protection Act (M.G.L. Ch. 131, s. 40, as amended) and the Town of Arlington By-Laws Article 8, By-Law for Wetland Protection, for a Request for Determination of Applicability from the Town of Arlington Engineering Division, for **Mystic Street Bridge Reconstruction Project on Mystic Street**, located within the 200 foot riverfront area and 100 foot wetland resource area for **Mill Brook**.

A copy of the application and accompanying plans are available for inspection Mon. – Thursday 8am to 4pm and Friday 8:00am to 12:00pm at the Conservation Commission office, first floor of the Town Hall Annex, located at 730 Massachusetts Avenue, and at the Engineering Division office, second floor of the Department of Public Works building, located at 23 Maple Street.

For more information call the Town of Arlington Engineering Division at 781-316-3320, the Arlington Conservation Commission at 781-316-3012, or the DEP Northeast Regional Office at 978-694-3200.

NOTE: Notice of the Public Hearing will be published at least five (5) days in advance in *The Arlington Advocate* and be posted not less than 48 hours in advance in the Arlington Town Hall of the public hearing.

TOWN OF ARLINGTON
Department of Public Works
51 Grove Street
Arlington, Massachusetts 02476
Office(781) 316-3320 Fax (781) 316-3281

Engineering Division

AFFIDAVIT OF SERVICE

(Return to Conservation Commission)

I, Wayne A. Chouinard, being duly sworn, do hereby state as follows: on November 10, 2022, mailed a "Notification to Abutters" in compliance with the second paragraph of Massachusetts General Laws, Chapter 131, s.40, the DEP Guide to Abutter Notification dated April 8, l994, and the Arlington Wetlands Protection Bylaw, Title V, Article 8 of the Town of Arlington Bylaws in connection with the following matter:

Mystic Street Bridge Reconstruction Project; Notice of Intent

The form of the notification, and a list of the abutters to whom it was provided and their addresses, are attached to this Affidavit of Service.

Signed under the pains and penalties of perjury, this 10th day of November 2022.

Name

Abutters List
Date: November 07, 2022

print this list

Subject Property Address: 0-LOT MYSTIC ST Arlington, MA
Subject Property ID: 63-4-6.A

Search Distance: 0 Feet

Owner: 87 MYSTIC STREET LLC
Co-Owner: ARMSTRONG AMBULANCE
Prop ID: 49-1-15.A
Prop Location: 87 MYSTIC ST Arlington, MA
Mailing Address:

87 MYSTIC ST
ARLINGTON, MA 02474

Owner: MYSTIC STREET 91 LLC
Co-Owner: C/O ROBERT BOWES
Prop ID: 49-1-16.A
Prop Location: 91 MYSTIC ST Arlington, MA
Mailing Address:
1010 MASS AVE
ARLINGTON, MA 02474

Owner: TOWN OF ARLINGTON CEMETERY
Co-Owner:
Prop ID: 49-1-17.A
Prop Location: 0-LOT MYSTIC ST Arlington, MA
Mailing Address:
730 MASS AVE
ARLINGTON, MA 02476

Owner: TOWN OF ARLINGTON CEMETERY
Co-Owner:
Prop ID: 49-1-19.B
Prop Location: 0-LOT MYSTIC ST Arlington, MA
Mailing Address:
730 MASS AVE
ARLINGTON, MA 02476

Owner: THRASHER PATRICK A--ETAL
Co-Owner: THRASHER JOANN G
Prop ID: 49-1-20.A
Prop Location: 105 MYSTIC ST Arlington, MA
Mailing Address:
105 MYSTIC ST
ARLINGTON, MA 02474

Owner: TOWN OF ARLINGTON CEMETERY
Co-Owner: MT. PLEASANT CEMETERY
Prop ID: 49-1-21
Prop Location: 39 SACHEM AVE Arlington, MA
Mailing Address:
730 MASS AVE
ARLINGTON, MA 02476

Owner: 77-79 MYSTIC STREET REALTY LLC
Co-Owner:
Prop ID: 49-2-17.A
Prop Location: 77-79 MYSTIC ST Arlington, MA
Mailing Address:
479 MAIN ST
WATERTOWN, MA 02472

Owner: TOMLINSON LINDSAY
Co-Owner: VALLE PIO ANGELO TEJERO
Prop ID: 49.A-1-19
Prop Location: 95 MYSTIC ST UNIT A Arlington, MA
Mailing Address:
95 MYSTIC ST UNIT A
ARLINGTON, MA 02474

Owner: HESS LORI V & DAVID P/ TRUSTEES
Co-Owner: LORI V HESS REVOCABLE TRUST
Prop ID: 49.A-1-20
Prop Location: 95 MYSTIC ST UNIT B Arlington, MA
Mailing Address:
97 MYSTIC ST
ARLINGTON, MA 02474

Owner: MAKOWKA STEPHEN/ETAL
Co-Owner: SPRING JOLIE C
Prop ID: 63-4-10
Prop Location: 17 RUSSELL ST Arlington, MA
Mailing Address:
17 RUSSELL ST
ARLINGTON, MA 02474

Owner: TOWN OF ARLINGTON
Co-Owner:
Prop ID: 63-4-3.A
Prop Location: 112 MYSTIC ST Arlington, MA
Mailing Address:
730 MASS AVE
ARLINGTON, MA 02476

Owner: TOWN OF ARLINGTON
Co-Owner:
Prop ID: 63-4-4.A
Prop Location: 0-LOT MYSTIC ST Arlington, MA
Mailing Address:
730 MASS AVE
ARLINGTON, MA 02476

Owner: TOWN OF ARLINGTON CON COM
Co-Owner:
Prop ID: 63-4-5.B
Prop Location: 0-LOT MYSTIC ST Arlington, MA
Mailing Address:
730 MASS AVE
ARLINGTON, MA 02476

Owner: BOSTON EDISON CO
Co-Owner: PROPERTY TAX DEPT
Prop ID: 63-4-5.C
Prop Location: 88 MYSTIC ST Arlington, MA
Mailing Address:

PO BOX 270
HARTFORD, CT 06141

Owner: CAHILL MARY ANN TRS--ETAL
Co-Owner: PIGOTT CHARLES A
Prop ID: 63-4-7.A
Prop Location: 82 MYSTIC ST Arlington, MA
Mailing Address:
47 DUDLEY ST
ARLINGTON, MA 02476

Owner: BOSTON EDISON CO
Co-Owner: PROPERTY TAX DEPT
Prop ID: 63-4-8
Prop Location: 0-LOT RUSSELL ST Arlington, MA
Mailing Address:
P.O. BOX 270
HARTFORD, CT 06141

Owner: KELLY JOSEPH F & JEANNE T
Co-Owner:
Prop ID: 63-4-8.C
Prop Location: 9-11 RUSSELL ST Arlington, MA
Mailing Address:
11 RUSSELL STREET
ARLINGTON, MA 02474

Owner: CANTAGALLO LISA M
Co-Owner: ADAMS KENNETH J III
Prop ID: 63-4-9
Prop Location: 15 RUSSELL ST Arlington, MA
Mailing Address:
15 RUSSELL STREET
ARLINGTON, MA 02474

Owner: BUCK STEPHEN R &
Co-Owner: COLEMAN JULIA H
Prop ID: 64-3-1.A

Prop Location: 127 MYSTIC ST Arlington, MA
Mailing Address:
127 MYSTIC ST
ARLINGTON, MA 02474

GEOTECHNCIAL REPORT

A-10-015 (7XF) Bridge Replacement
Mystic Street (US 3) over Mill Brook, Arlington, MA
December 2017

Prepared for:

TOWN OF ARLINGTON

GILL ENGINEERING

Gill Engineering Associates, Inc.
63 Kendrick Street
Needham, MA 02494

Table of Contents

Appendix

1. INTRODUCTION

1.1. Scope of Report

The purpose of this report is to provide recommendations for the foundations for the replacement of bridge A-10-015 (7XF) in Arlington, Massachusetts. The replacement is necessary due to the exiting bridge poor overall condition. This report will evaluate the data from the subsurface exploration program along with data from previous explorations and provide the necessary parameters for designing proposed foundations. All parameters provided will be in accordance with AASHTO LRFD 7th Edition Design Specifications and the 2013 LRFD MassDOT Bridge Manual. The report will also provide recommendations for the construction of proposed foundations with guidance on minimizing potential construction issues.

1.2. Existing Structure and Site History

Bridge No. A-10-015 (7XF) is located on Mystic Street (US 3) and spans over Water Mill Brook as illustrated in Appendix 5.1 - Project Locus Map. The existing bridge is a 2-span structure, originally constructed in 1850 using granite slabs supported on masonry walls. It was later widened in each direction in 1958 with a reinforced concrete slab supported on reinforced concrete bents and concrete gravity abutments. Portions of the original granite slab have been replaced with steel stringers sometime after the 1958 widening. The width of the existing structure consists of a 48-ft roadway and (2) 6-ft wide sidewalks. The length of the original 1850 structure is 21-ft while the lengths on the 1958 widened structure were extended out to 32.33-ft and 35.58-ft, on the west and east sides, respectively.

1.3. Site Description

The bridge is oriented north-to-south with a single travel lane in each direction and a lane designated for parking on each side. Mystic Street is classified as an Urban Arterial and has an ADT of roughly 26,000 as of 2017. The bridge is bounded by buildings at the southwest and northeast quadrant while the other two quadrants consist of open space.

Mill Brook flows from west to east at the bridge location. The stream channel has an area of aggregation which consists of cobble stones at the upstream location near the southwest corner of the bridge. This material may have been the result of erosion of the adjacent embankment.

The site has many utilities located within the roadway corridor and within the bridge crossing which include:

- 1-8” gas line below at west sidewalk below concrete slab (exposed)
- 2-10” MWRA Sanitary Sewer line at west sidewalk location below streambed
- 4-3.5” electric lines located within the roadway and above granite slabs

- 1-8” gas line within roadway and below granite slabs (exposed)
- 1-12” steel gas line within roadway and above granite slabs
- 8-3.5” electric lines located within the roadway and above granite slabs
- 2-8” water lines within roadway and below streambed
- 2-8” cast iron sewer lines within roadway and below streambed
- 1-8” gas line within roadway and below granite slabs (exposed)
- 1-6” steel unknown line and below granite slabs
- 4-4” steel telecom lines within roadway and above granite slabs
- 8-4” steel telecom lines within roadway and above granite slabs
- 2-12” electrical high-voltage black lines below east sidewalk below concrete slab
- 3-6” VCP drainage pipes through north abutment
- 1-12”RCP drainage pipe through north abutment
- 3-10” CIP drainage pipe through south abutment
- Overhead lines along west edge

See Proposed Preliminary Structure Plans in Appendix 5.4 for a location layout of the existing utilities along with proposed relocation.

2. SUBSURFACE CONDITIONS

2.1. Local Geology

According to the Natural Resources Conservation Service mapping, the site is underlain by fine to gravelly sandy loam to a depth of 65 inches. The underlay of rock may include Diorite & Gabbro, Dedham Granite, and Cambridge Argillite according to the Massachusetts Geologic Map data.

2.2. Subsurface Exploration Program

The extent of the subsurface exploration program consisted of two (2) soil borings located off the roadway in the southeast and northeast quadrant (designated as B-1 and B-2). The borings were drilled using a 4 inch casing and a 2-3/8 inch split spoon sampler over the course of three (3) business days between August 28th and August 30th, 2017 by Geologic-Earth Exploration, Inc. of Norfolk, Massachusetts, and observed by Gill Engineering Associates, Inc. (GEA). The observation included a visual and hands on examination of the soil samples. See Appendix 5.4 for an as-drilled boring locations and Appendix 5.3 for boring logs. GEA concurs with the information presented in the boring logs.

2.3. As-built Borings

The 1958 widening plans provide boring data at each corner of the widening. See Appendix 5.4. The borings describe the layers as course sand and gravel with boulders found in the upper 20-ft.

2.4. Subsurface Profile

2.4.1. South Abutment

The existing ground grade at BB-1 is at 15.0 which is 1.4 feet below road grade. The subsurface conditions typically consist of loose to medium dense granular soil consisting of a mixture of sand and gravel.

2.4.1.1. Top Layer

The top layer of soil is typically composed of loose fine to medium sand and gravel with a SPT value of 4 blows per foot (bpf). This layer appears to extend from existing grade down to a depth of 7-ft.

2.4.1.2. Upper Layer

Layers from 7-ft to the end of boring depth of 61-ft consists mostly of layers of medium dense gravel and layers of medium dense sand with a SPT value of ranging from 10 to 28.

2.4.1.3. Groundwater

Groundwater was not measured; therefore, it is assumed to be at the measured stream elevation of 9.0.

2.4.2. North Abutment

The existing ground grade at BB-2 is at 16.0 which is at .5 feet below road grade. The subsurface conditions typically consist of loose to medium dense granular soil consisting of a mixture of sand and gravel.

2.4.2.1. Upper Layer

The top layer of soil consists of stiff silt and fine sand over loose fine to course sand with SPT values from 4 to 9 blows per foot (bpf). This layer appears to extend from existing grade down to a depth of 7 feet.

2.4.2.2. Lower Layers

Layers from 7-ft to the end of boring depth of 58-ft consists mostly of layers of medium dense gravel and layers of medium dense sand with a SPT value of ranging from 13 to 29.

2.4.2.3. Groundwater

Groundwater was not measured; therefore, it is assumed to be at the measured stream elevation 9.0.

2.4.3. Soil Parameters

See Table 1 for recommended soil parameters for design.

Table 1: Recommended Soil Parameters

Layer	Unit Weight γ (lb/ft^3)	Friction Angle Φ
Upper (0' to 6')	115	32
Lower (>6')	120	34
Gravel Borrow	125	37

1. Friction angle based upon SPT $N1_{60}$ Correlation and AASHTO Table 10.4.6.2.4-1
2. Gravel borrow per MassDOT M1.03.0

2.5. Seismic Design Category Evaluation

Seismic design parameters were determined using the AASHTO Guide Specifications for LRFD Seismic Bridge Design, 2nd Edition 2011 with Interims thru 2015, and the 2013 MassDOT Bridge Manual. Calculations are presented in Appendix 5.5 – Preliminary Design Calculations. The following are recommended seismic parameters for design:

Site Class (AASHTO Table 3.4.2.1-1): D (Medium dense soil with 15<N<50 blows/ft)

Mapped Ground and Spectral Response (AASHTO LRFD Seismic Bridge Design):
2% Probability of Exceedance in 50 Years (2,500 year event) since the bridge is considered a critical/essential bridge being on a NHS route:

- Peak Horizontal Ground Acceleration (PGA): 0.080
- Horizontal Response Spectral Acceleration, 0.2 Sec (S_S): 0.17
- Horizontal Response Spectral Acceleration, 1.0 Sec (S_1): 0.035

Site Factors (AASHTO LRFD Seismic Bridge Design, Table 3.4.2.3-1, Table 3.4.2.3-2):

- Zero-Period (F_{pga}): 1.6
- Short Period (F_a): 1.6
- Long Period (F_v): 2.4

Design Spectral Response Parameters for Site Class D:

- A_S: 0.13 G
- S_{DS}: 0.27 G

- S_{D1}: 0.08 G

Seismic Design Category (AASHTO LRFD Seismic Bridge Design, Table 3.5-1)

- SDC: A

2.6. Liquefaction Potential

Based on the soil conditions found at the bridge site, seismically induced settlement should not be significant and therefore there is a low potential for liquefaction in the event of seismic activity. The soils present are medium dense and well graded. Additionally, the site has a low probability of having an event that would trigger liquefaction (M<6.0).

3. RECOMMENDED FOUNDATION SYSTEM

3.1. Foundation Constraints

The location has many constraints for construction of a foundation including the following:

- Utilities-As noted in Section 1.3, many utilities are present within the bridge crossing. As such, the construction of the foundation system should be able to minimize disruption to these utilities.
- Nearby Buildings-The site has adjacent buildings located at the southwest and northeast quadrant of the bridge. The foundation installation shall minimize damage to these structures.
- Scour-The foundation shall be scour resistant or countermeasure should be in place to accommodate future scour.
- Control of Water-Consideration should be made in order to minimize foundation depths due to the presence of high ground water.
- Temporary Structures- Construction of the bridge and its foundations will require it to build in two stages; therefore, requiring a temporary structure to retain the roadways. An attempt should be made to minimize limits of any temporary structures in order to minimize impacts to utilities and nearby buildings.
- Obstructions-The proposed foundation should be located outside of the limits of the existing structure in order to minimize obstructions created by the existing structure. Boulders were found in the 1958 widening plan borings.

3.2. Shallow Foundation

The granular soil does provide adequate bearing resistance to support a spread footing foundation. Any settlements from foundation loads could be accommodated during construction. However, the depth of the footing will need to be low enough to accommodate frost protection and be lower than the depth of scour if adequate scour countermeasures are not provided. Also, the depth of the

foundation may conflict with the MWRA sanitary sewer and the Town water lines and sewer that are presently located below the stream bed.

3.3. Deep Foundation

If a shallow foundation cannot meet the constraints then a deep foundation may be the preferred alternative. It is recommended that the deep foundation be drilled-in versus driven due to the near proximity of utilities and buildings. A deep foundation supported on a reinforced concrete pile cap will reduce the required excavation as the bottom of the cap will not need not be as deep as a spread footing.

A foundation supported on micropiles is recommended for this site since it can be installed with drilling in order to limit vibrations. Lower installation height requirements needed for equipment will also help minimize impacts to overhead utilities. Furthermore, piles can be easily relocated in the field to accommodate conflicts and obstructions.

Micropiles may be used to support an integral abutment type superstructure as described in Section 3.10 of the 2013 MassDOT LRFD Bridge Manual. This type of design will allow a single row piles as the superstructure will provide lateral support with its rigid connection to the abutment. Since piles will be non-standard, a more refined Finite Element Analysis Method will be required for the design as described Section 3.10.11.5. This method will require the use of either L-Pile or Group Pile to model the soil–structure interactions. Recommended values for this type of analysis are listed below in Table 2.

Table 2: Recommended Soil Parameters

Layer	Unit Weight γ (pcf)	Friction Angle Φ	Soil Modulus K (pci)
Upper (0' to 6')	115	32	20
Lower (>6')	120	34	90
Lower Submerged (>6')	57.6	34	60

A preliminary micropile design was performed per AASHTO LRFD Bridge Design 7th Edition to determine the required size and length of the piles to support 32'-4" single span steel W24x62 superstructure. Summary of the design is provided in Table 3. See Appendix 5.4 for preliminary plans and Appendix 5.5 for calculations.

Table 3: Micropile Design Results

#Piles/Abut	9
Casing	9.625" Dia. (API N80 Pipe)
Reinforcement	#11 bar (75 ksi)
Grout	4 ksi (Method B)
Pile Length	30 feet
Grout Length	15 feet
Max Fact Load	82 Kips (Strength I)
Fact Structural Resistance	ϕR=0.80 X 117 Kips=94 Kips
Fact Geotechnical Resistance	ϕR=0.55 X 172 Kips=95 Kips

A settlement analysis was also performed on the pile group per AASHTO LRFD Bridge Design 7th Edition. Settlements will be less than 0.25-in and will occur during construction.

4. CONSTRUCTION CONSIDERATIONS

4.1. Water Table

Groundwater was not measured during the subsurface exploration due to the rotary wash method. Therefore, the water table was assumed to be at the stream channel elevation of 9.0. Fluctuations with this elevation are expected with the seasonal flows of the stream. A bottom of footing below this elevation will require dewatering during construction in order to maintain construction in the dry. Discharge of pumped water should be performed in accordance with all federal, state and local regulations which may require a discharge permit.

4.2. Excavation

As required by OSHA regulations, lateral support is required for any excavation depth greater than four feet and where 1.5:1 slope cannot be maintained. Items for temporary earth support should be included in the contract documents. The design of any temporary support of earth (SOE) is the responsibility of the Contractor and should be designed in accordance with MassDOT and AASHTO requirements.

Due to tight site constraints, temporary support of earth (SOE) will likely be required along construction staging lines and near existing buildings. As with the permanent foundation, it is recommended not to use a driven foundation such as steel sheet pile. A drilled-in soldier pile with timber lagging or a gravity type structure is recommended.

4.3. Obstructions

As previously discussed, it is recommended to locate the proposed foundation outside the footprint of the existing foundation to minimize obstructions. Since the bridge site is located within an urban setting other abandoned foundations and utilities, bricks or cobbles may be present within the subsurface of the site. The existing 1958 widening plans did note boulders in the upper 20 feet. Additionally, abandoned streetcar rails are known to exist below the southbound roadway surface.

4.4. Protection of Adjacent Structures and Utilities

As previously stated, the bridge carries multiple utilities. Care shall be taken to properly identify and relocate all utilities as necessary during construction to minimize impacts. Staging plans detailing the relocation of these utilities will be required.

Utilities that are sensitive to movement and vibrations should be monitored. Utility owners should be consulted to establish threshold limits for movement and vibrations.

It is recommended that a preconstruction survey be conducted on existing structures within 100 feet of proposed construction. The survey shall document all pre-existing cracks, settlements, displacements, spalling, damage or other pre-existing adverse effect of each structure using descriptions, video, photographs, measurements and survey techniques.

4.5. Sequence of Construction Activities

The replacement bridge is to be constructed using staged construction. It is anticipated that the construction staging will occur in two phases. Backfilling behind the abutment stems and wing walls should be performed in accordance with MassDOT Standard Specifications. It is important to follow procedures set forth in the specifications to avoid unbalanced loading effects for which the structure is not designed. Temporary excavation support should be in place before excavations for foundations or subgrades are made.

4.6. Micropile Installation

It is recommended to use temporary or permanent casing through the granular soils in order to maintain an open hole to allow proper placement of grout. Grouting should be performed through a tremie pipe under pressure in order to improve the grout to ground bond strength. Centralizers shall be used with the reinforcement to maintain grout cover.

Field testing shall include both a performance test on a verification pile and proof testing on one production pile per abutment. Testing shall be done per Procedure A-Quick Test of ASTM D1143, “Standard Test Method for Piles Under Static Axial Compressive Load” or per Procedure A – Quick Test of ASTM D3689-07. “Standard Test Methods for Deep Foundations Under Static Tensile Load”.

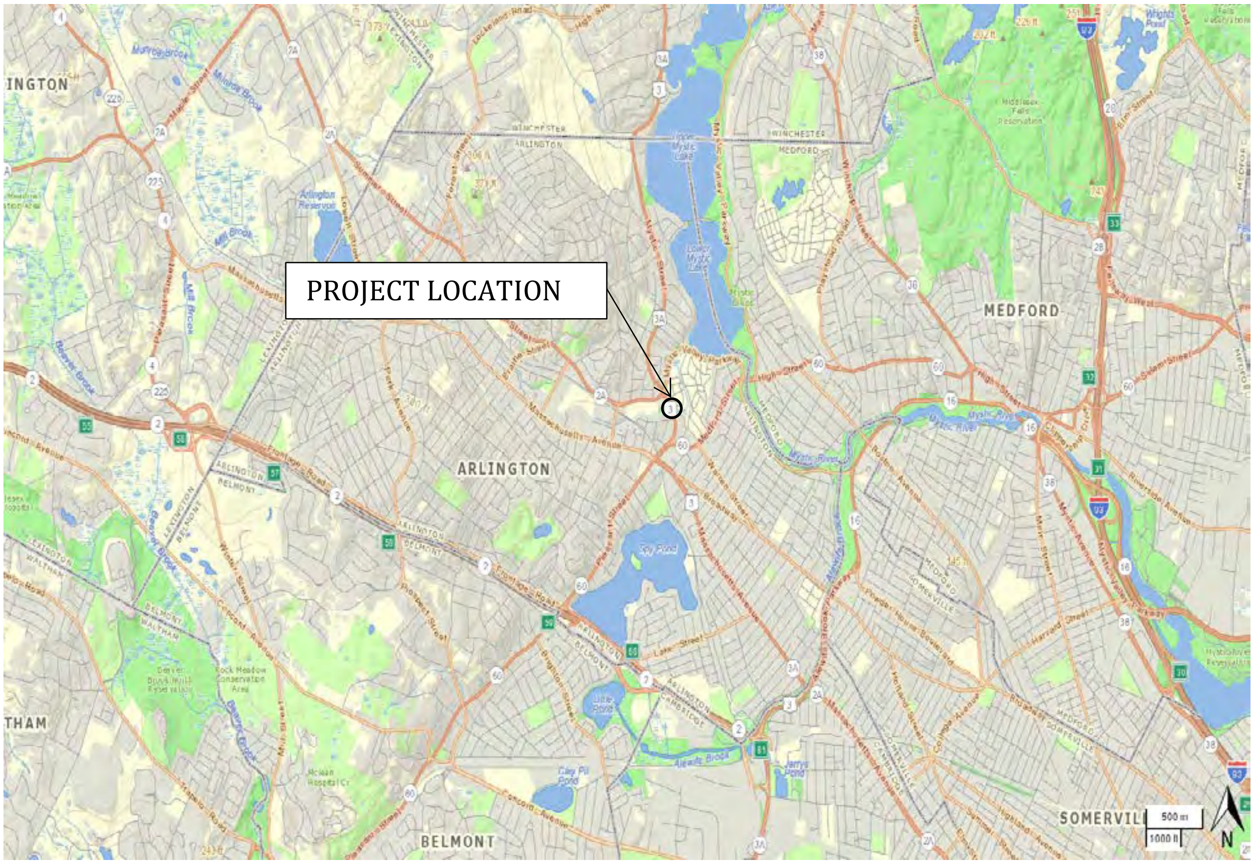
4.7. Special Construction Considerations

Special care should be taken to adhere to the guidelines and policies outlined out by the Massachusetts Department of Environmental Protection (MassDEP) in Policy # COMM-97-001 as well as the 310 CMR 40.0000: Massachusetts Contingency Plan. Excavated soil should be tested by an approved laboratory for contaminants at reporting thresholds outlined in 310 CMR 40.1600: Massachusetts Oil and Hazardous Materials List. If reportable compounds are present, excavated material must be transported and disposed of at a MassDEP approved location. Contaminated material that has been excavated will not be permitted to use as backfill. Testing and transportation of any contaminated soil shall be included as an item in the contract documents and shall be the responsibility of the Contractor.

APPENDIX

5.1. Project Locus Map

APPENDIX


PROJECT LOCATION
ARLINGTON
MEDFORD
BELMONT
SOMERVILL
500 m
1000 ft
N

APPENDIX

5.2. Boring Logs

Geologic - Earth Exploration, Inc.		BORING #: B-1
7 Sherwood Drive, Norfolk, MA 02056 TEL 508 384 4434 FAX 508 384 4452	CLIENT: Gill Engineering, Inc. PROJECT: 91 Mystic Street LOCATION: Arlington, MA	PAGE 1 OF 1

			CASING	SAMPLER	CORE BARREL	
File #:	17143					Surface Elevation: 17.0
Date Started:	8/28/17	TYPE	HW	SS		Station: 1+40, 63' RT
Date Completed:	8/29/17	SIZE	4"	2 3/8"		Groundwater level readings
Driller:	P.Fisher	HAMMER	300#	140#	---	Date ___ Depth N/O
Site Rep.:		FALL	30"	30"	---	Date ___ Depth ___

Depth ft	Sample No.	Depth ft	Pen. in	Rec. in	Blows/6"	Sample Description
	S-1	0.0-2.0	24	12	2-2-2-2	S-1 Dry loose brown fine to medium SAND and GRAVEL
	S-2	4.0-6.0	24	6	2-2-2-2	S-2 Moist loose brown medium to coarse SAND and GRAVEL, some fine Sand
10	S-3	9.0-11.0	24	1	18-12-10-10	S-3 Moist medium dense gray to brown fine to coarse GRAVEL
	S-4	14.0-16.0	24	2	15-5-5-4	S-4 Moist medium dense dark gray fine to coarse GRAVEL, some Sand
20	S-5	19.0-21.0	24	1	9-4-9-8	S-5 Moist medium dense gray fine to medium GRAVEL, trace Sand
	S-6	24.0-26.0	24	12	11-10-6-4	S-6 Moist medium dense gray fine SAND, trace of Silt and Gravel
30	S-7	29.0-31.0	24	6	16-16-12-11	S-7 Similar to S-6
	S-8	34.0-36.0	24	6	14-10-9-10	S-8 Similar to S-6
40	S-9	39.0-41.0	24	8	13-8-7-8	S-9 Moist medium dense gray fine SAND and GRAVEL, some fine to coarse Sand
	S-10	44.0-46.0	24	6	11-13-6-9	S-10 Similar to S-9
50	S-11	49.0-51.0	24	4	9-6-5-8	S-11 Moist medium dense fine to coarse SAND and GRAVEL, little fine Sand
	S-12	54.0-56.0	24	8	7-14-10-13	S-12 Moist medium dense gray GRAVEL and fine to coarse SAND
60	S-13	59.0-61.0	24	8	15-9-10-12	S-13 Moist medium dense gray fine to coarse SAND, little Gravel
						Bottom of exploration at 61.0' -0'-41' DONUT HAMMER USED -41'-56' AUTOMATIC HAMMER USED

Ground Surface to ________ used ________ then ________

Proportions Used		Cohesive Consistency Blows/ft				Cohesionless Density Blows/ft		Sample Type
Trace	0 to 10%	0-2	Very Soft	9-15	Stiff	0-10	Loose	UP = Fixed Piston
Little	10 to 20%	3-4	Soft	16-30	V-Stiff	10-30	M-Dense	UT = Shelby Tube
Some	20 to 35%	5-8	M-Stiff	31+	Hard	30-50	Dense	OE = Open End Rod
And	35 to 50%					50+	V-Dense	* = 300# hammer

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks: NOTE: All soil descriptions are made in the field by the Drilling Foreman. No laboratory analyses were performed for this purpose.

Geologic - Earth Exploration, Inc.

7 Sherwood Drive, Norfolk, MA 02056
TEL 508 384 4434
FAX 508 384 4452

CLIENT: Gill Engineering, Inc.
PROJECT: 91 Mystic Street
LOCATION: Arlington, MA

BORING #: B-2

File #:	17143		CASING	SAMPLER	CORE BARREL	Surface Elevation: 15.5
Date Started:	8/29/17	TYPE	HW	SS		Station: 2+40, 70' LT
Date Completed:	8/30/17	SIZE	4"	1 3/8"		Groundwater level readings
Driller:	K.Eastwood	HAMMER	300#	140#	---	Date ____ Depth N/O
Site Rep.:		FALL	30"	30"	---	Date ____ Depth ____

Depth ft	Sample No.	Depth ft	Pen. in	Rec. in	Blows/6"	Sample Description
	S-1	0.0-2.0	24	6	2-5-4-5	S-1 Moist stiff brown SILT and fine SAND, TOPSOIL and Roots
	S-2	4.0-6.0	24	5	7-2-2-3	S-2 Moist loose dark brown fine to coarse SAND, some sandy Silt
10	S-3	9.0-11.0	24	3	17-11-15-16	S-3 Moist medium dense gray fine to coarse GRAVEL, some silty Sand
	S-4	14.0-16.0	24	5	8-9-6-13	S-4 Moist medium dense gray fine to coarse SAND and GRAVEL, trace gray Silt
20	S-5	19.0-21.0	24	6	6-8-9-7	S-5 Moist medium dense gray fine to medium GRAVEL, little Sand
	S-6	24.0-26.0	24	6	9-8-5-8	S-6 Moist medium dense gray fine to coarse GRAVEL, little gray Sand
30	S-7	29.0-31.0	24	5	8-9-8-9	S-7 Similar to S-6
	S-8	34.0-36.0	24	2	13-13-11-12	S-8 Similar to S-6
40	S-9	39.0-41.0	24	5	14-16-13-15	S-9 Moist medium dense gray fine to coarse SAND and GRAVEL
	S-10	44.0-46.0	24	8	11-12-11-14	S-10 Similar to S-9
50	S-11	49.0-51.0	24	9	12-15-14-14	S-11 Moist medium dense brown SAND and GRAVEL, little Loam and fine Sand
	S-12	54.0-56.0	24	10	21-23-22-17	S-12 Moist medium dense gray fine to coarse SAND and GRAVEL, trace gray Silt No sample was recovered with the 2" split sppon. 3" split sppon used instead. Rock was found at the end of the sample
	S-13	56.0-58.0	24	12	10-9-9-8	S-13 Moist medium dense gray fine to coarse silty SAND, trace gray Silt 2' Split spoon extension used w/o drilling
60						Bottom of exploration at 58.0' AUTOMATIC HAMMER USED

Ground Surface to ____ used ____ then ____

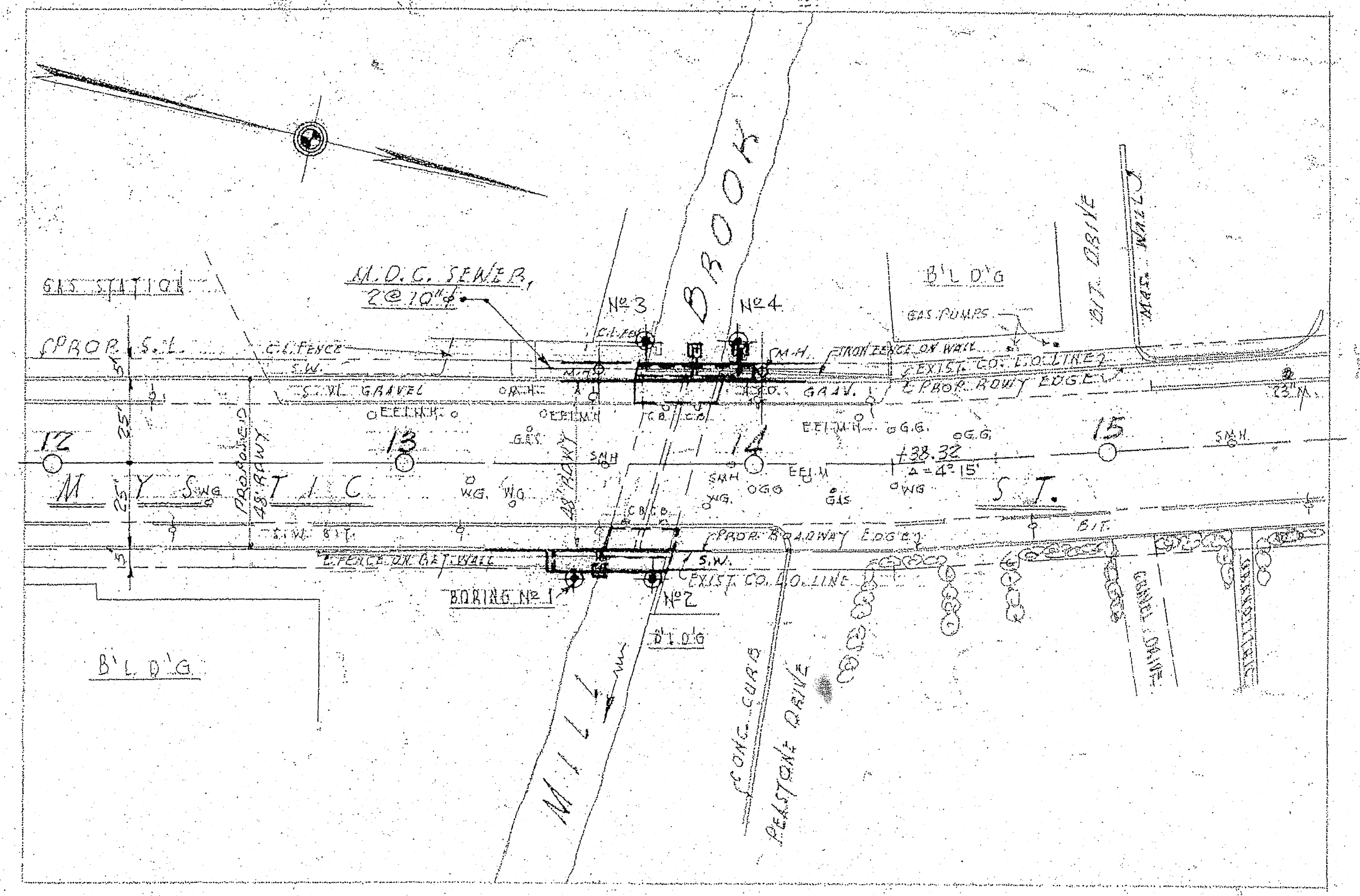
Proportions Used		Cohesive Consistency Blows/ft				Cohesionless Density Blows/ft		Sample Type
Trace	0 to 10%	0-2	Very Soft	9-15	Stiff	0-10	Loose	UP = Fixed Piston
Little	10 to 20%	3-4	Soft	16-30	V-Stiff	10-30	M-Dense	UT = Shelby Tube
Some	20 to 35%	5-8	M-Stiff	31+	Hard	30-50	Dense	OE = Open End Rod
And	35 to 50%					50+	V-Dense	* = 300# hammer

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks: NOTE: All soil descriptions are made in the field by the Drilling Foreman. No laboratory analyses were performed for this purpose.

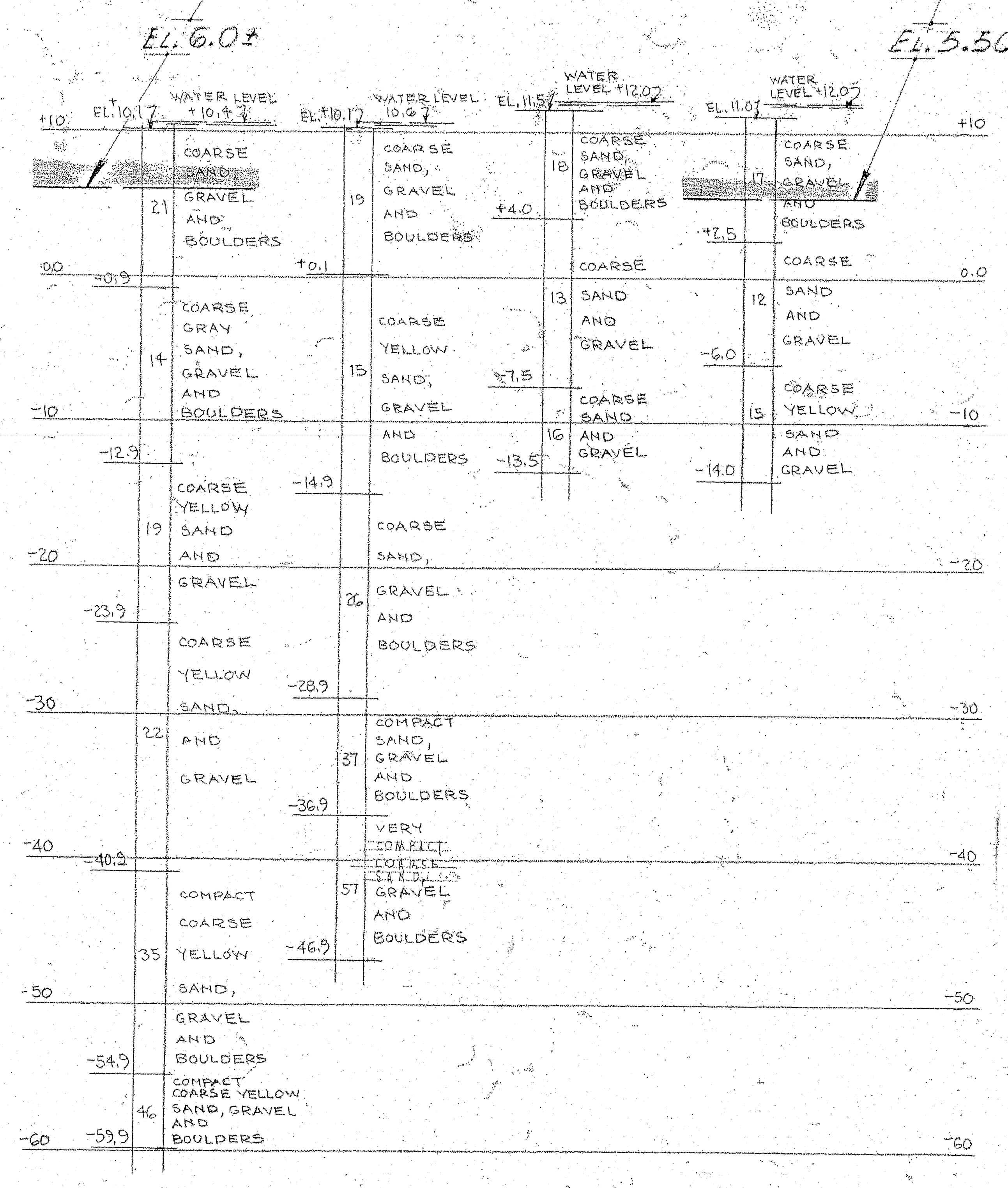
APPENDIX

5.3. 1958 As-Built Widening Plans



PLAN
SCALE 1" = 40'-0"

BOTTOMS OF PROPOSED FOUNDATIONS



BORING DATA
BORINGS TAKEN BY CARR CONSTRUCTION CORP. JAN. 1958.
SCALE 1" = 8'-0"

GENERAL NOTES

FOUNDATIONS:
MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED IN CONSTRUCTION.

REINFORCEMENT:
ALL REINFORCING STEEL BARS SHALL CONFORM TO A.S.T.M. SPECIFICATION A-305. UNLESS OTHERWISE SHOWN ON THE PLANS, REINFORCING BARS SHALL BE LAPPED 20 DIAMETERS TO MAKE A SPLICE, EXCEPT THAT MAIN REINFORCING BARS NEAR THE TOP OF SLABS AND BEAMS HAVING MORE THAN 12 INCHES OF CONCRETE UNDER THE BARS SHALL BE LAPPED 35 DIAMETERS TO MAKE A SPLICE.

BORING NOTES:
LOCATIONS OF BORINGS SHOWN ON KEY PLAN THUS: No.3. BORINGS TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORING POINTS ONLY, BUT DO NOT NECESSARILY SHOW NATURE OF MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION. FIGURES IN COLUMNS INDICATE BLOWS PER FOOT ON 1" Ø PIPE PRODUCED BY 30 INCH FALL OF 140 POUND HAMMER. BORING SAMPLES MAY BE SEEN AT THE DEPARTMENT'S LABORATORY IN THE MAINTENANCE BUILDING ON ROUTE No. 9 IN WELLESLEY.

DESIGN:
IN ACCORDANCE WITH THE CURRENT SPECIFICATIONS OF THE A.A.S.H.O. FOR H 20-44 LOADING.

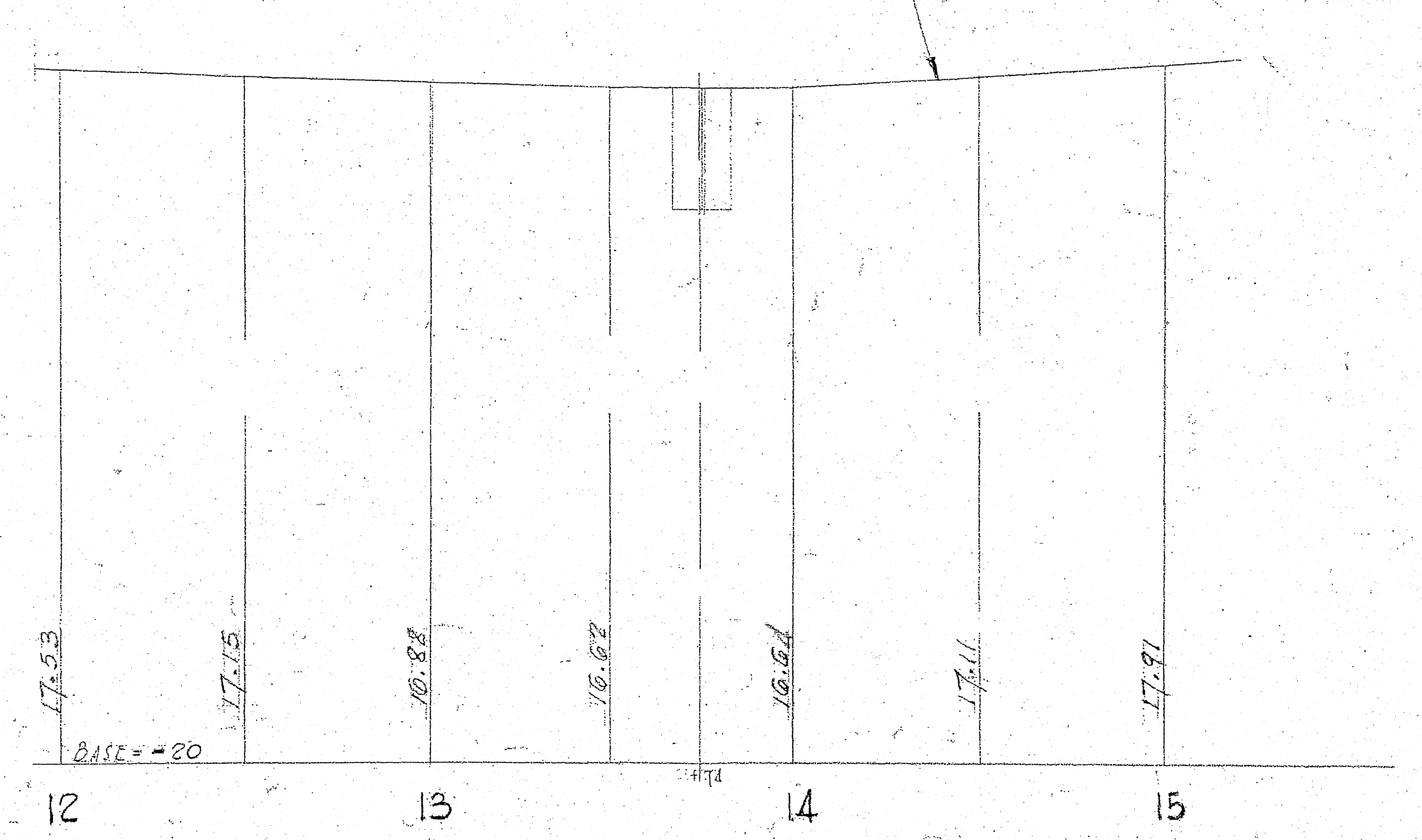
DATE:
TO BE PLACED IN CENTRE OF OUTSIDE FACES OF SIDEWALK BEAMS. FOR SIZE AND CHARACTER OF NUMERALS, SEE ANOTHER SHEET.

BENCH MARK:
HYDRANT (L) STATION 10+59, EL. 21.59.

ESTIMATED QUANTITIES
NOT GUARANTEED

BRIDGE EXCAVATION	84 C.Y.
CLASS B ROCK EXCAVATION	5 C.Y.
MASONRY EXCAVATION	5 C.Y.
CLASS A CEM. CONC. MASONRY	45 C.Y.
STEEL REINF. FOR STRUCTURES	7,900 LBS.
CEMENT FOR POINTING	2 BBLS.
BITUMINOUS DAMP-PROOFING	30 S.Y.
METAL BRIDGE RAILING - TYPE H	66 L.F.
FRAMES & GRATES REMOVED & RESET	4 EA.
GRANITE CURB, TYPE VA5, STR. 6"x11"	70± L.F.
ALTERATIONS TO PIPE RAIL FENCE	1 L.S.

PROPOSED SURFACE TO BE 2"± ABOVE EXISTING SURFACE



PROFILE OF MYSTIC STREET
HORIZONTAL SCALE 1" = 40'-0" VERTICAL SCALE 1" = 8'-0"

DESIGNED BY	MAY 24, 1958	ISSUED FOR CONSTRUCTION
RAMSEY		

DRAWN BY
RAMSEY
ROCHE
CHECKED BY
AHERNE

APPROVED FOR
DESIGN
L.H. Rasmussen
ARCHITECTURE
SPECS.
K.G. Hulsman

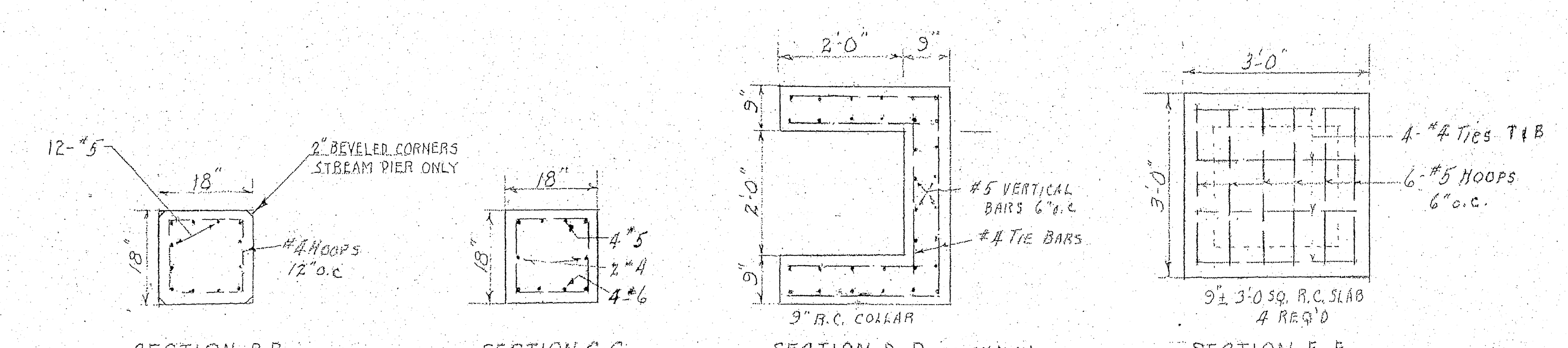
THE COMMONWEALTH OF MASSACHUSETTS
PROPOSED BRIDGE
EXTENSION
ARLINGTON
MYSTIC STREET, STATION 13+73±
OVER MILL BROOK
SCALES AS NOTED
OFFICE OF
DEPARTMENT OF PUBLIC WORKS
100 NASHUA ST. BOSTON, MASS.
MAY 1958

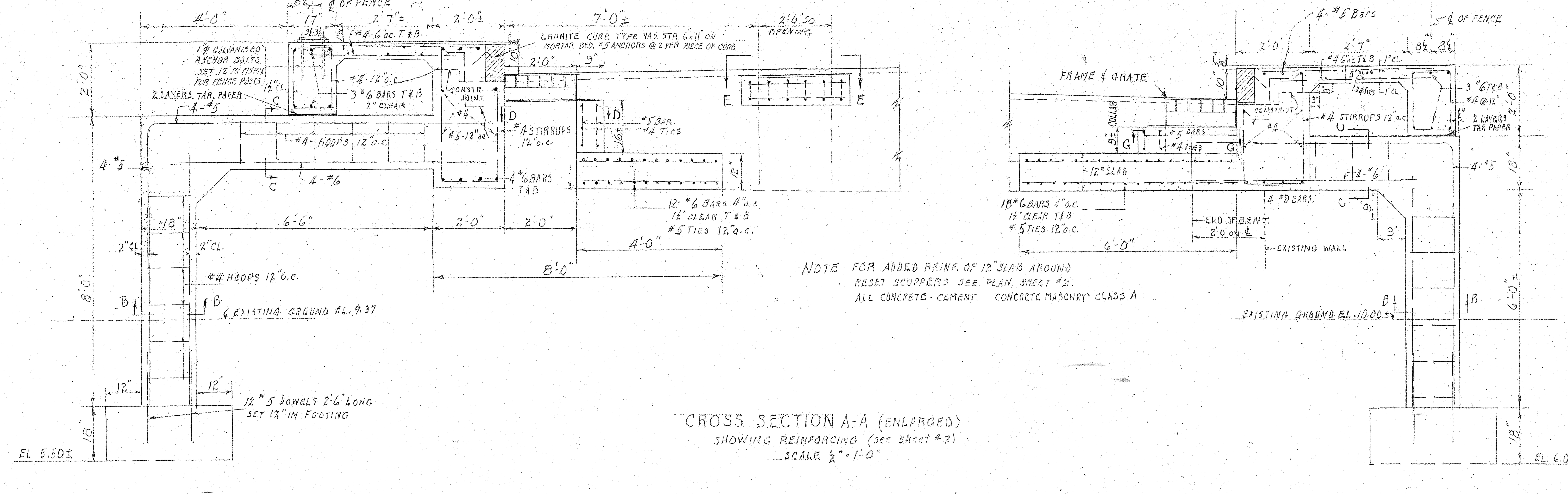
J. H. Kane
ACTING BRIDGE ENGINEER

E. J. McCarthy
CHIEF ENGINEER

SHEET 1 OF 3 SHEETS · BRIDGE No. A-10-15

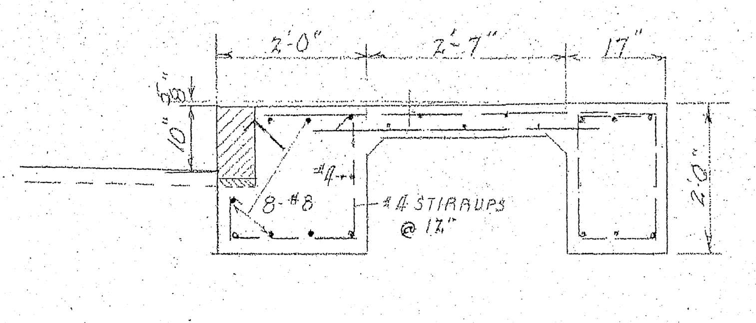

PLAN
SCALE 1/4" = 1'-0"
MILL BROOK
BLDG.
ALTERATIONS TO EXISTING FENCE (BY OTHERS)
4 PANELS @ 7'-8 1/4" = 30'-9"
℄ M.B. RAILING
FACE EXISTING COPING
FACE OF CURB
12" REINF. CONC SLAB
TYPICAL ADDED STEEL #5 BARS 6" o.c. T&B 4 REQ'D
REMOVE & RESET F.&G.
34'-0"± 14" GRANITE SLABS 2'-0"± WIDE (EXISTING)
EXISTING 11'-0"± 10" CONC. SLAB
PROPOSED 9"± SLAB 3'x3' 2" BELOW FINISHED GRADE 2 EACH PRES. GUTTER
BLOCK OUT PRESENT WALL FOR PROPOSED STRUCTURAL SUPPORT - SEE CROSS SECTION
4 PANELS @ 8'-6" = 34'-0"
PROPOSED TOE WALL
BRICK UP
ALTERATIONS TO EXISTING FENCE
35'-7"
13+50
14
CROSS SECTION A-A
SCALE 1/4" = 1'-0"
℄ OF SURVEY & ℄ OF CONSTRUCTION
PROPOSED 48'-0" ROADWAY
PRESENT 34'-6"± ROADWAY
CROSS HATCHED PORTION TO BE EXCAVATED THRU OUT LENGTH OF BR.
REMOVE FRAMES AND GRATES & COVER OPENING WITH 9"± R.C. SLAB 3' SQ. 2" BELOW FINISHED GRADE
RESET FRAMES & GRATES 1/2" BELOW FINISHED GRADE ON 3 SIDES, 3" COLLAR
FINISHED GRADE 2" ABOVE PRESENT GRADE
BRICK UP AT WALL
14" GRANITE SLABS 2'± WIDE
10" R.C. SLAB EXISTING
12" R.C. SLAB PROPOSED
BITUMINOUS DAMPPROOFING
EASTERLY ELEVATION
SCALE 1/4" = 1'-0"
35'-7"
4 PANELS @ 8'-6" = 34'-0"
METAL BRIDGE RAILING (TYPE H)
S.E. EL. 17.03
N.E. EL. 16.90
1958
PRESENT WALL TO BE CUT OUT FOR SIDEWALK BEARING
PRES. BROOK BED
PROPOSED CONCRETE TOE WALL FROM OUT SIDE PRESENT COPING TO PRESENT BUILDING LINE - #5 Dowels 18" o.c. set 6" in masonry
EL. 11.50±
EL. 6.0±
WESTERLY ELEVATION
SCALE 1/4" = 1'-0"
32'-4"
4 PANELS @ 7'-8 1/4" = 30'-9"
METAL BRIDGE RAILING (TYPE H)
N.W. EL. 17.17
S.W. EL. 17.07
1958
PRESENT CONC WALL TO BE CUT OUT & KEYED FOR SIDEWALK BEARING
PRES. BROOK BED
PRES. M.D.C. SEWER LINE
EL. 5.50±
MAY 24, 1958 ISSUED FOR CONSTRUCTION
DATE DESCRIPTION
USE ONLY PRINTS OF LATEST DATE
SHEET 2 OF 3 SHEETS BRIDGE No. A-10-15



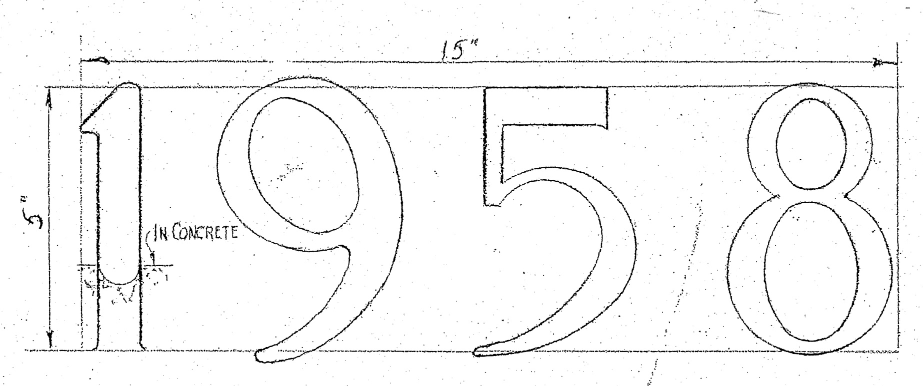


NOTE FOR ADDED REINF. OF 12" SLAB AROUND RESET SCUPPERS SEE PLAN, SHEET #2.
ALL CONCRETE - CEMENT CONCRETE MASONRY CLASS A

CROSS SECTION A-A (ENLARGED)
SHOWING REINFORCING (see sheet #2)
SCALE ½" = 1'-0"



SECTION F-F
SCALE ½" = 1'-0"



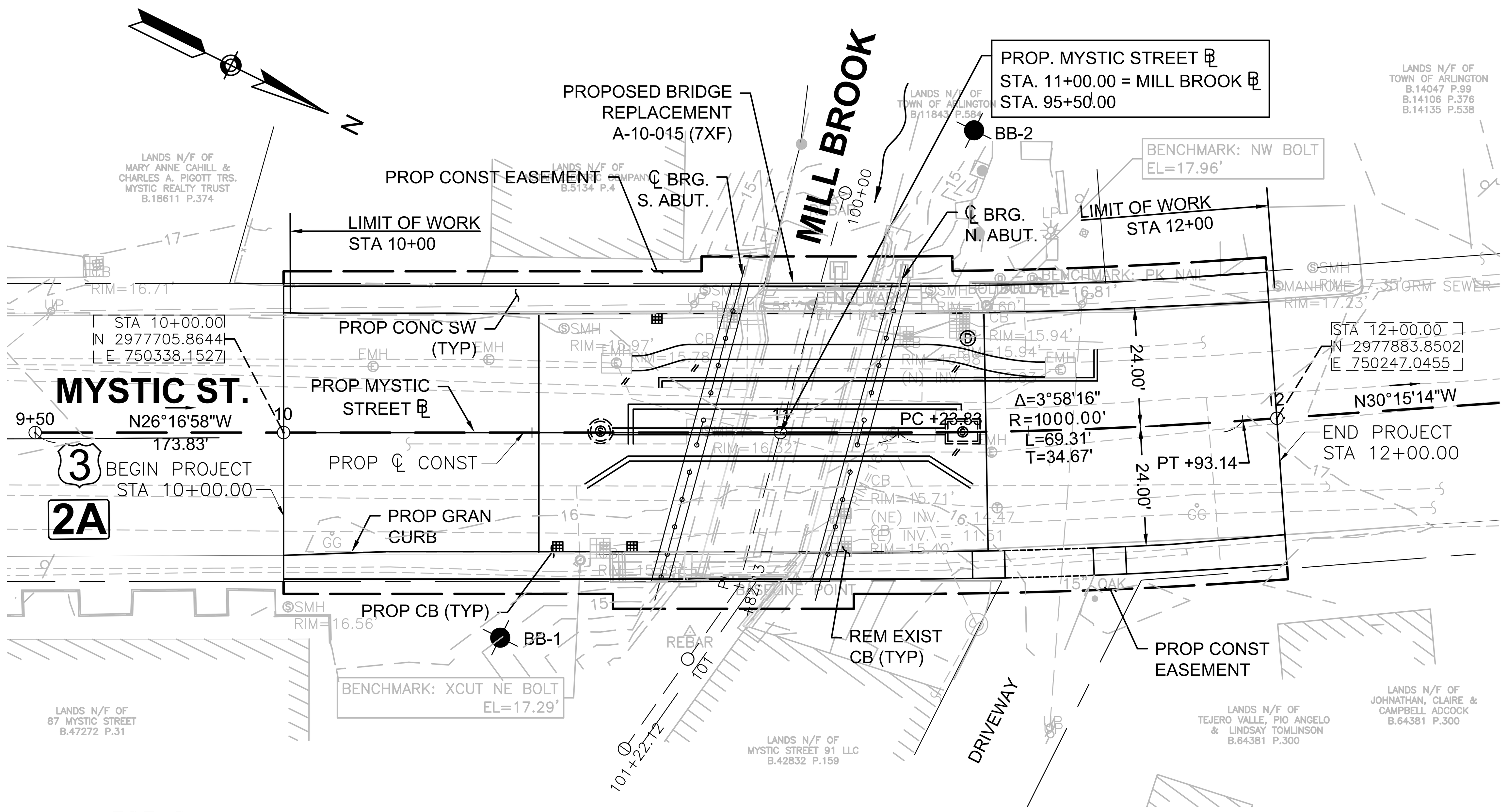
DETAIL OF BRIDGE DATE

MAY 24, 1958	ISSUED FOR CONSTRUCTION
DATE	DESCRIPTION
USE ONLY PRINTS OF LATEST DATE	

SHEET 3 OF 3 SHEETS BRIDGE NO. A-10-15

APPENDIX

5.4. Proposed Preliminary Structure Plans

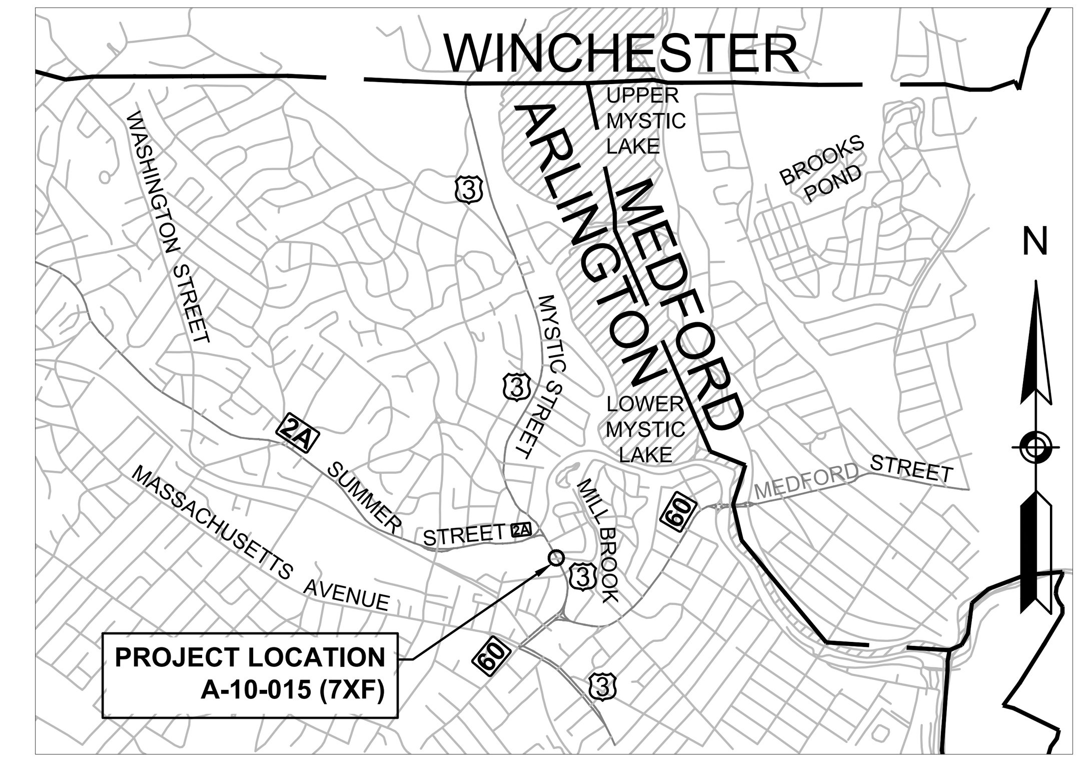


LEGEND:

SOIL BORING

KEY PLAN

SCALE: 1" = 20'



LOCUS

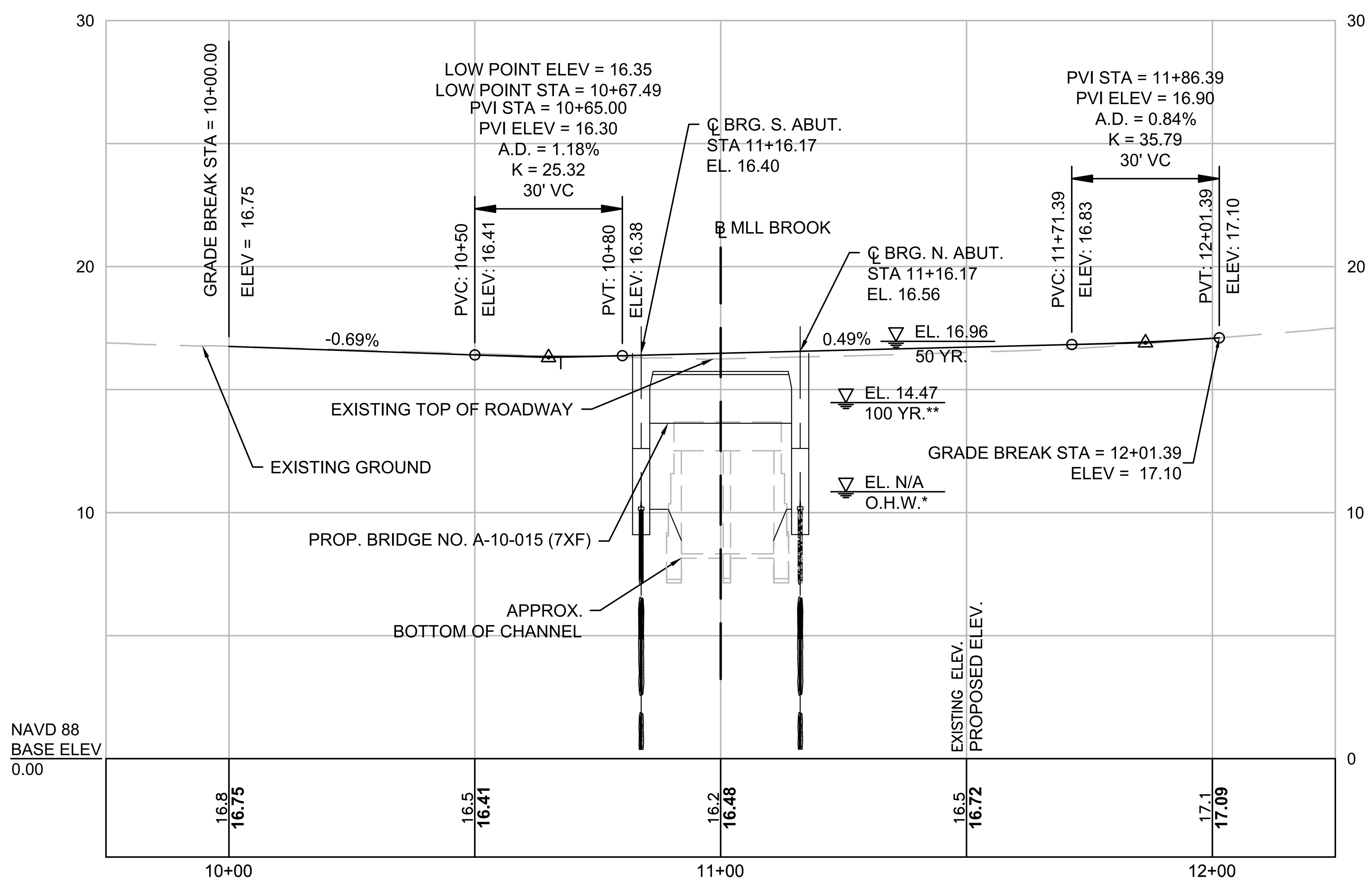
SCALE: 1" = 2000'

INDEX OF DRAWINGS

SHEET NO.	SHEET TITLE
1	KEY PLAN & GENERAL NOTES
2	BORINGS
3	GENERAL PLAN & LONGITUDINAL SECTION
4	ABUTMENT DETAILS
5	EXISTING & PROPOSED SECTION
6	CONSTR. STAGING
7	ROADWAY PLAN & TYPICAL SECTION
8	UTILITY PLAN
9	TWO PHASE TRAFFIC PLAN
10	ADVANCE SIGNING

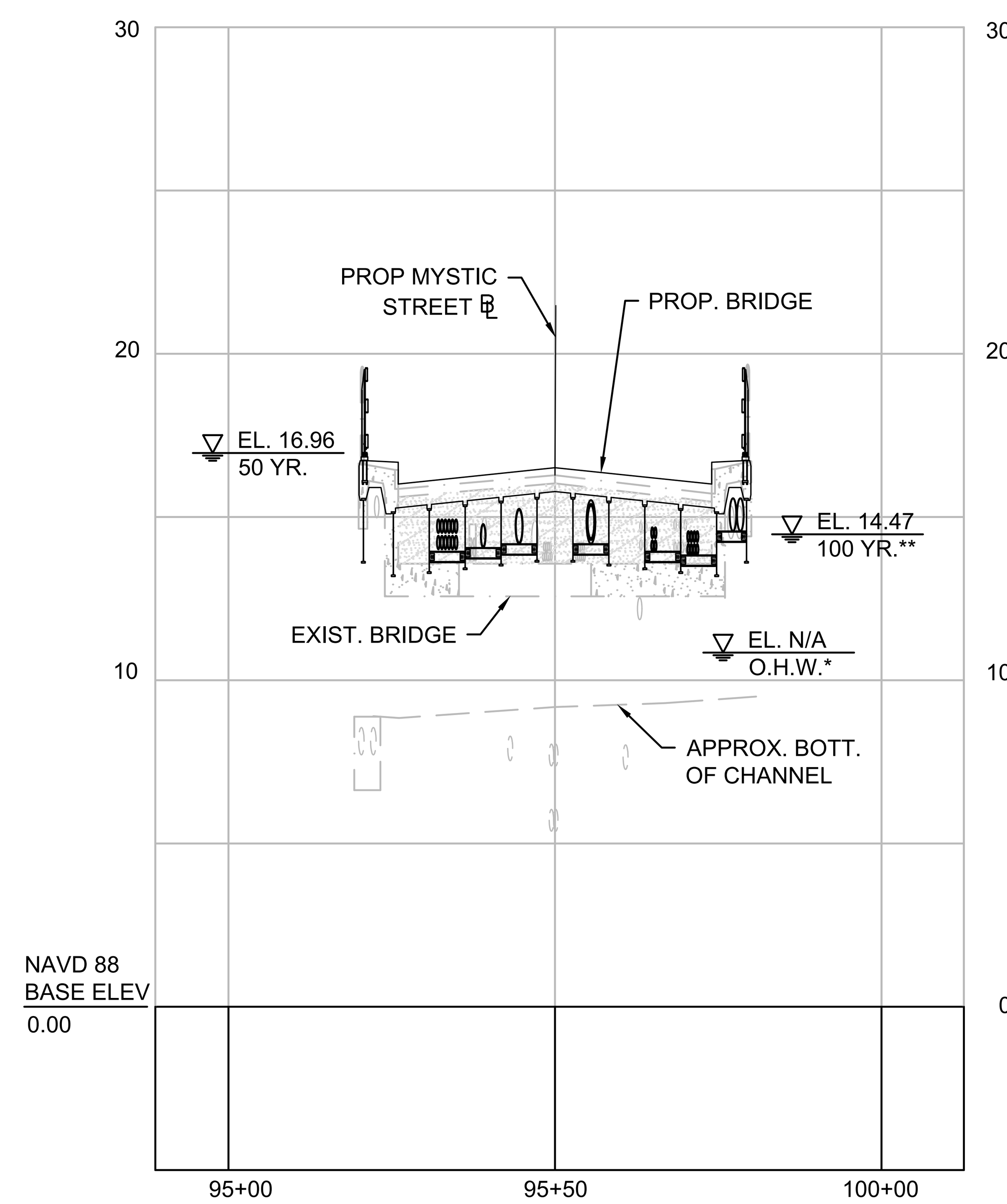
HYDRAULIC DESIGN DATA		
DRAINAGE AREA:	5.05	SQ. MILES
DESIGN FLOOD DISCHARGE:	750	C.F.S
DESIGN FLOOD FREQUENCY:	50	YEARS
DESIGN FLOOD VELOCITY:	3.18	F.P.S.
DESIGN FLOOD ELEVATION:	16.96	FEET, NAVD
BASE (100-YEAR) FLOOD DATA		
BASE FLOOD DISCHARGE:	450	C.F.S
BASE FLOOD ELEVATION:	14.47	FEET, NAVD
DESIGN AND CHECK SCOUR DATA		
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY:	100	YEARS
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY:	500	YEARS
FLOOD OF RECORD		
DISCHARGE:	UNKNOWN	
FREQUENCY (IF KNOWN):	UNKNOWN	
MAXIMUM ELEVATION:	UNKNOWN	
DATE:	UNKNOWN	
HISTORY OF ICE FLOES:	NONE DOCUMENTED IN NBIS DATABASE	
EVIDENCE OF SCOUR AND EROSION:	NONE DOCUMENTED IN NBIS DATABASE	

*O.H.W. OBSERVED HIGH WATER DATA IS NOT AVAILABLE
**THE 100-YR BASE FLOOD DATA IS FROM THE FEMA FIS



PROPOSED PROFILE – MYSTIC STREET

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



PROFILE – MILL BROOK

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'

DESIGN:

IN ACCORDANCE WITH THE 2014 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS WITH CURRENT INTERIM SPECIFICATIONS THROUGH 2016, FOR HL-93 LOADING.

NOTES:

1. SEE GEOTECHNICAL REPORT, DATED DECEMBER 2017.
2. SEISMIC DESIGN CRITERIA:
   DESIGN RETURN PERIOD: 1000 YEARS
   DESIGN CRITERIA:
   A_s = 0.13G
   S_{DS} = 0.27G
   S_{D1} = 0.08G
   SITE CLASS = D
   SEISMIC DESIGN CATEGORY (SDC) = A
3. SEE HYDRAULIC REPORT DATED DECEMBER 2017.
4. ALL ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

63 KENDRICK STREET
NEEDHAM, MA 02494
781-355-7100
781-355-7101 (FAX)

GILL ENGINEERING

DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION	DATE
12/19/2017	ABL	ABL	SBC	25% SUBMITTAL	

REGISTERED PROFESSIONAL ENGINEER

BRIDGE REPLACEMENT
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (7XF)
US3 (MYSTIC STREET) OVER MILL BROOK

KEY PLAN & GENERAL NOTES

SHEET 1 OF 10

Geologic - Earth Exploration, Inc.

7 Sherwood Drive, Norfolk, MA 02056
TEL 508 384 4434 FAX 508 384 4452

CLIENT: Gill Engineering, Inc.
PROJECT: 91 Mystic Street
LOCATION: Arlington, MA
BORING #: B-1
PAGE 1 OF 1

			CASING	SAMPLER	CORE BARREL	
File #:	17143					Surface Elevation:
Date Started:	8/28/17	TYPE	HW	SS		Station:
Date Completed:	8/29/17	SIZE	4"	2 3/8"		Groundwater level readings
Driller:	P.Fisher	HAMMER	300#	140#	---	Date ___ Depth N/O
Site Rep.:		FALL	30"	30"	---	Date ___ Depth ___

Depth ft	Sample No.	Depth ft	Pen. in	Rec. in	Blows/6"	Sample Description
	S-1	0.0-2.0	24	12	2-2-2-2	S-1 Dry loose brown fine to medium SAND and GRAVEL
	S-2	4.0-6.0	24	6	2-2-2-2	S-2 Moist loose brown medium to coarse SAND and GRAVEL, some fine Sand
10	S-3	9.0-11.0	24	1	18-12-10-10	S-3 Moist medium dense gray to brown fine to coarse GRAVEL
	S-4	14.0-16.0	24	2	15-5-5-4	S-4 Moist medium dense dark gray fine to coarse GRAVEL, some Sand
20	S-5	19.0-21.0	24	1	9-4-9-8	S-5 Moist medium dense gray fine to medium GRAVEL, trace Sand
	S-6	24.0-26.0	24	12	11-10-6-4	S-6 Moist medium dense gray fine SAND, trace of Silt and Gravel
30	S-7	29.0-31.0	24	6	16-16-12-11	S-7 Similar to S-6
	S-8	34.0-36.0	24	6	14-10-9-10	S-8 Similar to S-6
40	S-9	39.0-41.0	24	8	13-8-7-8	S-9 Moist medium dense gray fine SAND and GRAVEL, some fine to coarse Sand
	S-10	44.0-46.0	24	6	11-13-6-9	S-10 Similar to S-9
50	S-11	49.0-51.0	24	4	9-6-5-8	S-11 Moist medium dense fine to coarse SAND and GRAVEL, little fine Sand
	S-12	54.0-56.0	24	8	7-14-10-13	S-12 Moist medium dense gray GRAVEL and fine to coarse SAND
60	S-13	59.0-61.0	24	8	15-9-10-12	S-13 Moist medium dense gray fine to coarse SAND, little Gravel
						Bottom of exploration at 61.0' -0'-41' DONUT HAMMER USED -41'-56' AUTOMATIC HAMMER USED

BOTTOM OF PROP. SOUTH ABUTMENT EL. 11.05

EST. PILE TIP EL. −18.79

Ground Surface to ______ used ______ then ______

Proportions Used		Cohesive Consistency Blows/ft				Cohesionless Density Blows/ft		Sample Type
Trace	0 to 10%	0-2	Very Soft	9-15	Stiff	0-10	Loose	UP = Fixed Piston
Little	10 to 20%	3-4	Soft	16-30	V-Stiff	10-30	M-Dense	UT = Shelby Tube
Some	20 to 35%	5-8	M-Stiff	31+	Hard	30-50	Dense	OE = Open End Rod
And	35 to 50%					50+	V-Dense	* = 300# hammer

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks: NOTE: All soil descriptions are made in the field by the Drilling Foreman. No laboratory analyses were performed for this purpose.

BL ALL 17143 GILL, ARLINGTON, MA.GPJ GEOLOGIC.GDT 11/3/17

NOTE:
APPROXIMATE LOCATION OF BB−1
GROUND SURFACE EL. 15.0
STA 10+43.6, OFFSET 41.33' RT

Geologic - Earth Exploration, Inc.

7 Sherwood Drive, Norfolk, MA 02056
TEL 508 384 4434 FAX 508 384 4452

CLIENT: Gill Engineering, Inc.
PROJECT: 91 Mystic Street
LOCATION: Arlington, MA
BORING #: B-2
PAGE 1 OF 1

			CASING	SAMPLER	CORE BARREL	
File #:	17143					Surface Elevation:
Date Started:	8/29/17	TYPE	HW	SS		Station:
Date Completed:	8/30/17	SIZE	4"	1 3/8"		Groundwater level readings
Driller:	K.Eastwood	HAMMER	300#	140#	---	Date ___ Depth N/O
Site Rep.:		FALL	30"	30"	---	Date ___ Depth ___

Depth ft	Sample No.	Depth ft	Pen. in	Rec. in	Blows/6"	Sample Description
	S-1	0.0-2.0	24	6	2-5-4-5	S-1 Moist stiff brown SILT and fine SAND, TOPSOIL and Roots
	S-2	4.0-6.0	24	5	7-2-2-3	S-2 Moist loose dark brown fine to coarse SAND, some sandy Silt
10	S-3	9.0-11.0	24	3	17-11-15-16	S-3 Moist medium dense gray fine to coarse GRAVEL, some silty Sand
	S-4	14.0-16.0	24	5	8-9-6-13	S-4 Moist medium dense gray fine to coarse SAND and GRAVEL, trace gray Silt
20	S-5	19.0-21.0	24	6	6-8-9-7	S-5 Moist medium dense gray fine to medium GRAVEL, little Sand
	S-6	24.0-26.0	24	6	9-8-5-8	S-6 Moist medium dense gray fine to coarse GRAVEL, little gray Sand
30	S-7	29.0-31.0	24	5	8-9-8-9	S-7 Similar to S-6
	S-8	34.0-36.0	24	2	13-13-11-12	S-8 Similar to S-6
40	S-9	39.0-41.0	24	5	14-16-13-15	S-9 Moist medium dense gray fine to coarse SAND and GRAVEL
	S-10	44.0-46.0	24	8	11-12-11-14	S-10 Similar to S-9
50	S-11	49.0-51.0	24	9	12-15-14-14	S-11 Moist medium dense brown SAND and GRAVEL, little Loam and fine Sand
	S-12	54.0-56.0	24	10	21-23-22-17	S-12 Moist medium dense gray fine to coarse SAND and GRAVEL, trace gray Silt No sample was recovered with the 2" split sppon. 3" split sppon used instead. Rock was found at the end of the sample
	S-13	56.0-58.0	24	12	10-9-9-8	S-13 Moist medium dense gray fine to coarse silty SAND, trace gray Silt 2' Split spoon extension used w/o drilling
60						Bottom of exploration at 58.0' AUTOMATIC HAMMER USED

BOTTOM OF PROP. NORTH ABUTMENT EL. 11.21

EST. PILE TIP EL. −18.95

Ground Surface to ______ used ______ then ______

Proportions Used		Cohesive Consistency Blows/ft				Cohesionless Density Blows/ft		Sample Type
Trace	0 to 10%	0-2	Very Soft	9-15	Stiff	0-10	Loose	UP = Fixed Piston
Little	10 to 20%	3-4	Soft	16-30	V-Stiff	10-30	M-Dense	UT = Shelby Tube
Some	20 to 35%	5-8	M-Stiff	31+	Hard	30-50	Dense	OE = Open End Rod
And	35 to 50%					50+	V-Dense	* = 300# hammer

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks: NOTE: All soil descriptions are made in the field by the Drilling Foreman. No laboratory analyses were performed for this purpose.

BL ALL 17143 GILL, ARLINGTON, MA.GPJ GEOLOGIC.GDT 11/3/17

NOTE:
APPROXIMATE LOCATION OF BB−2
GROUND SURFACE EL. 16.0
STA 11+40.5, OFFSET 56.5' LT

BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON THE KEY PLAN THUS: ⊕
2. BORINGS ARE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORINGS POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A 1 3/8" I.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30".
5. ALL BORINGS WERE MADE IN AUGUST 2017.
6. BORING WERE MADE BY: GEOLOGIC − EARTH EXPLORATION, INC., 7 SHERWOOD DRIVE, NORFOLK, MA 02056
7. THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.
8. BORING SAMPLES ARE STORED IN THE ARLINGTON DEPARTMENT OF PUBLIC WORKS BUILDING AT 51 GROVE STREET, ARLINGTON, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE ENGINEERING DIVISION AT 781−316−3320.

GILL ENGINEERING
63 KENDRICK STREET
NEEDHAM, MA 02494
781-355-7100
781-355-7101 (FAX)

DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION

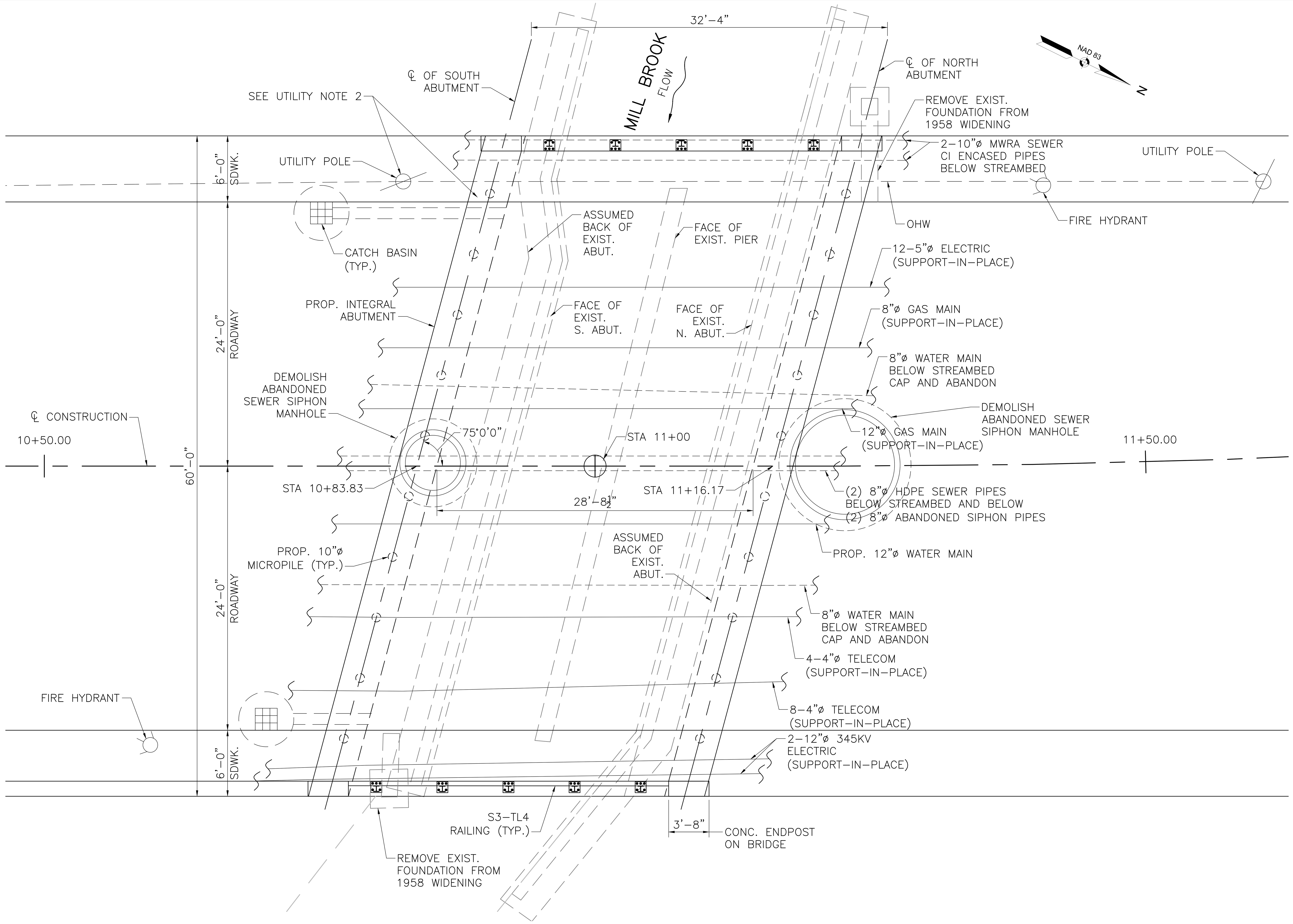
REGISTERED PROFESSIONAL ENGINEER ______ DATE

BRIDGE REPLACEMENT
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A−10−015 (7XF)
US3 (MYSTIC STREET) OVER MILL BROOK

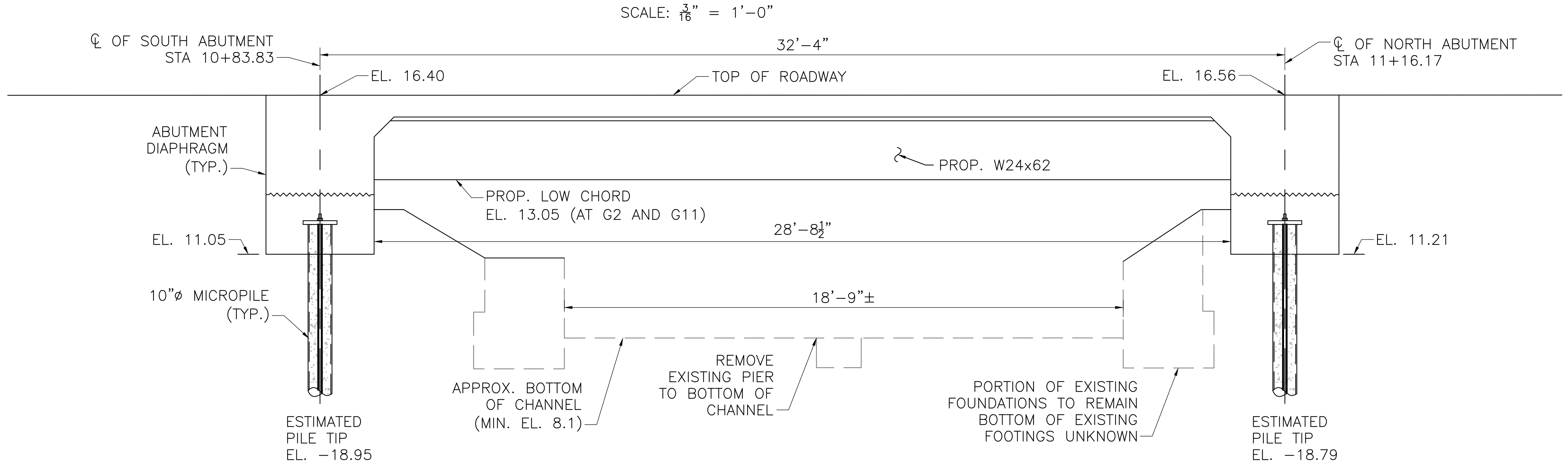
BORINGS

SHEET 2 OF 10



PLAN OF BRIDGE

SCALE: 3/16" = 1'-0"



LONGITUDINAL SECTION OF BRIDGE

SCALE: 3/8" = 1'-0"

UTILITY NOTES:

1. UTILTIES AND UTILITY STRUCTURES BEYOND THE BRIDGE ARE OMITTED FOR CLARITY. SEE SHEET 8 FOR INFORMATION NOT SHOWN.
2. IT IS ANTICIPATED THAT A TRENCH BOX WILL BE REQUIRED TO CONSTRUCT THE ABUTMENT DIAPHRAGM IN THIS LOCATION, TO MAINTAIN AND PROTECT THE UTILITY POLE.
3. THE TOWN SIPHON SEWER WILL BE RELOCATED PRIOR TO BRIDGE CONSTRUCTION UNDER A SEPARATE CONTRACT. CONTRACTOR TO DEMOLISH EXISTING ABANDONED SEWER SIPHON MANHOLES.
4. EARLY THIRD-PARTY UTILITY COORDINATION HAS INDICATED THAT THE ELECTRIC CONDUITS AND GAS MAINS WILL BE RELOCATED PRIOR TO BRIDGE CONSTRUCTION. THESE CONDUITS, IN ADDITION TO THE TELECOM CONDUITS BELOW THE NORTHBOUND ROADWAY AND THE HIGH VOLTAGE ELECTRIC LINES BELOW THE EASTERN SIDEWALK, SHALL BE SUPPORTED IN PLACE THROUGHOUT CONSTRUCTION.
5. CONTRACTOR TO DESIGN, MAINTAIN, AND PROTECT THE TEMPORARY UTILITY SUPPORT SYSTEMS.
6. THE (2) 8"ø TOWN WATER LINES BELOW THE STREAMBED WILL BE CAPPED AND ABANDONED. A SINGLE 12"ø INSULATED PIPE WILL BE CARRIED ON THE PROPOSED STRUCTURE. THIS WORK WILL BE PERFORMED UNDER THE BRIDGE CONTRACT.

SUBSTRUCTURE NOTES:

1. THE MAXIMUM PRELIMINARY FACTORED AXIAL DESIGN LOAD PER PILE IS 82 KIPS AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS (EXTREME EVENT OR STRENGTH 1) LOAD COMBINATION.
2. THE FACTORED STRUCTURAL PILE RESISTANCE IS 94 KIPS AND IS THE PRODUCT OF THE NOMINAL STRUCTURAL RESISTANCE OF 117 KIPS AND A RESISTANCE FACTOR OF 0.80.
3. THE FACTORED GEOTECHNICAL PILE RESISTANCE IS 95 KIPS AND IS THE PRODUCT OF THE NOMINAL GEOTECHNICAL RESISTANCE OF 172 KIPS AND A RESISTANCE FACTOR OF 0.55.
4. EXISTING ABUTMENT AND PIER LIMITS ARE APPROXIMATE.
5. EXISTING ABUTMENTS ARE DRY LAID GRANITE, THUS DEMOLITION LIMITS SHOWN ARE APPROXIMATE.

GILL ENGINEERING
63 KENDRICK STREET
NEEDHAM, MA 02494
781-355-7100
781-355-7101 (FAX)

DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION

REGISTERED PROFESSIONAL ENGINEER

DATE

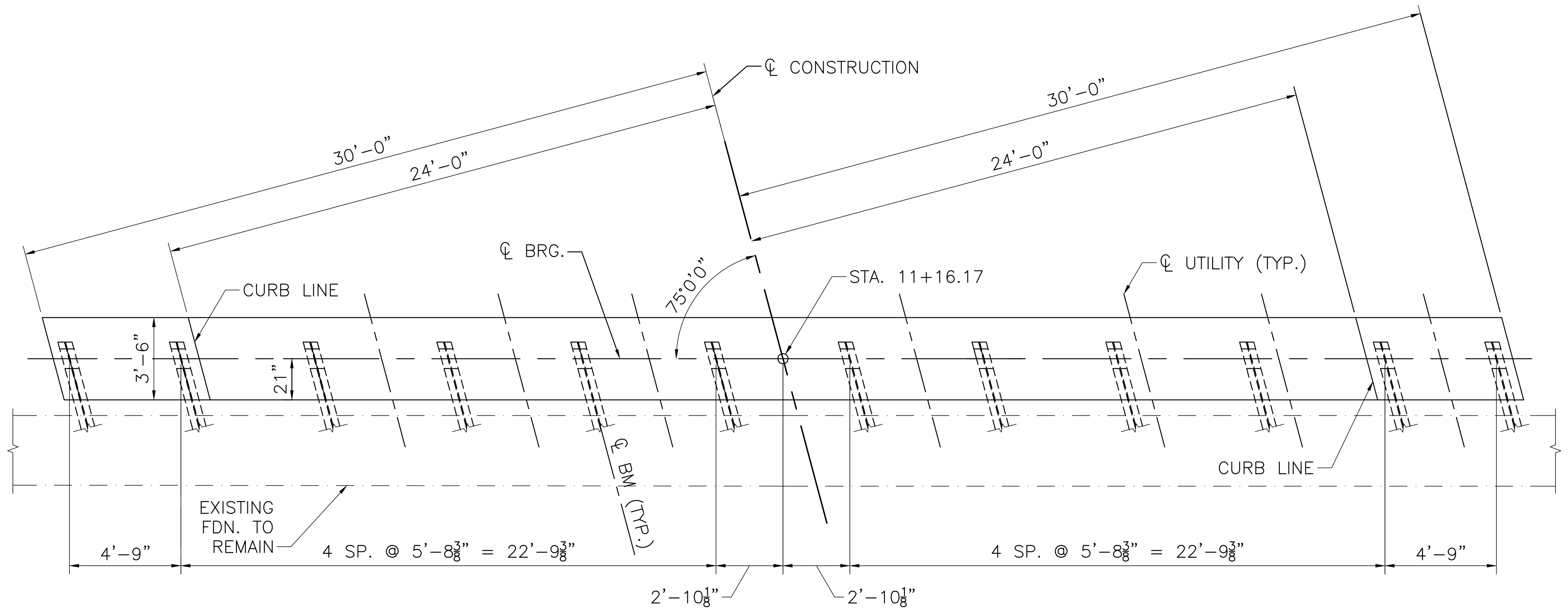
BRIDGE REPLACEMENT

TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT A-10-015 (7XF) US3 (MYSTIC STREET) OVER MILL BROOK

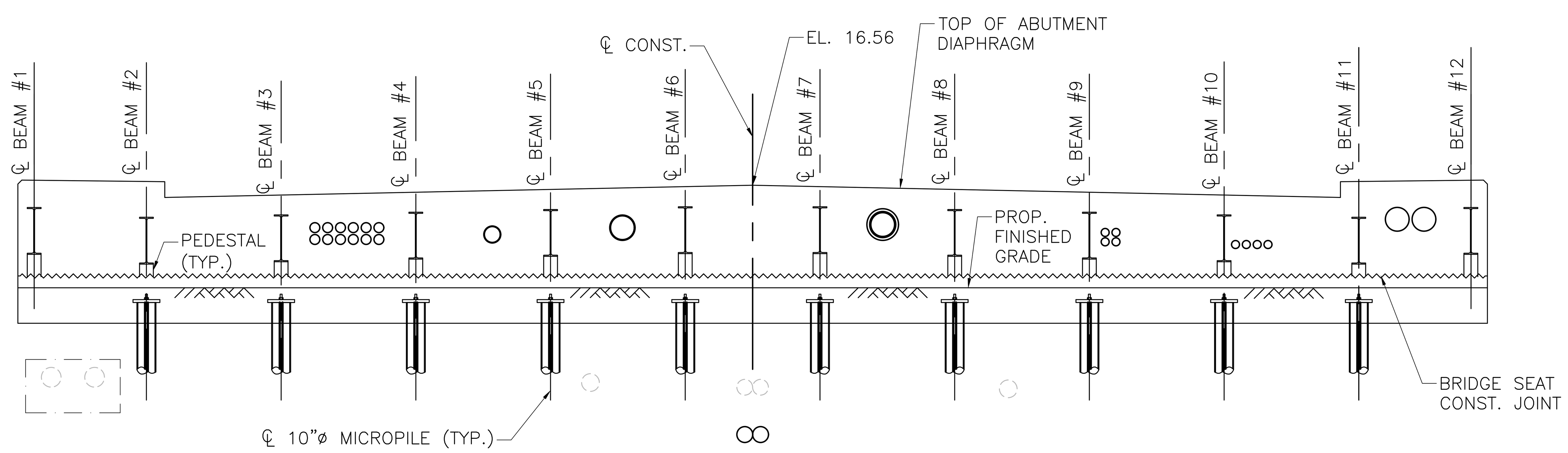
GENERAL PLAN & LONGITUDINAL SECTION

SHEET 3 OF 10

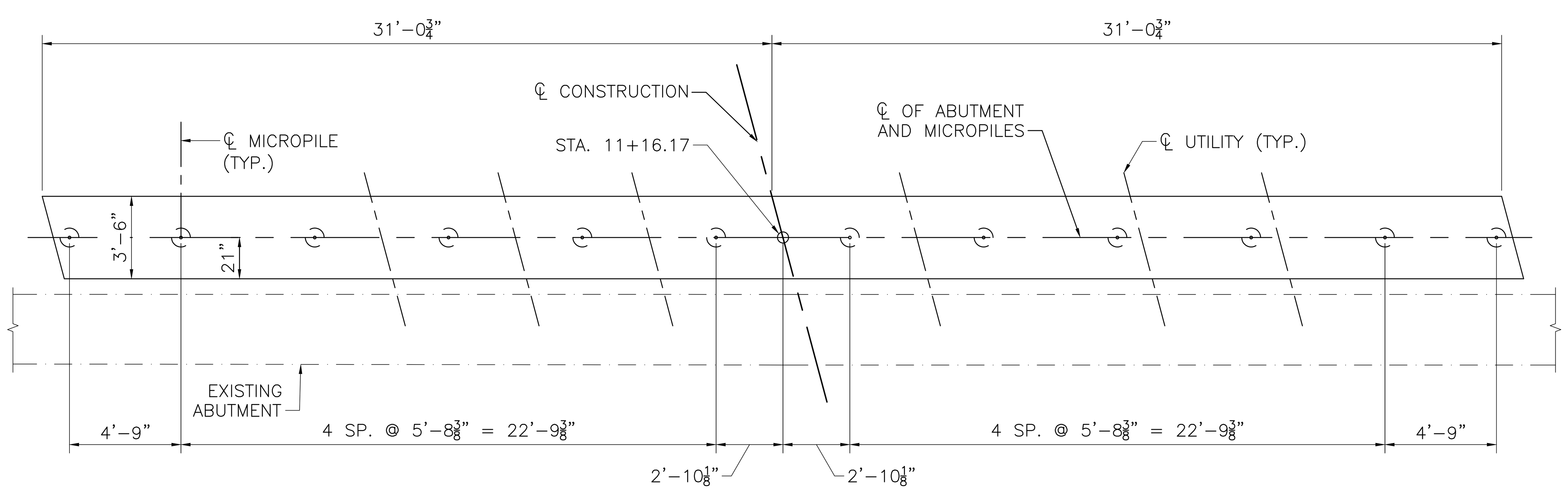


NOTE:
NORTH ABUTMENT SHOWN, SOUTH SIMILAR.

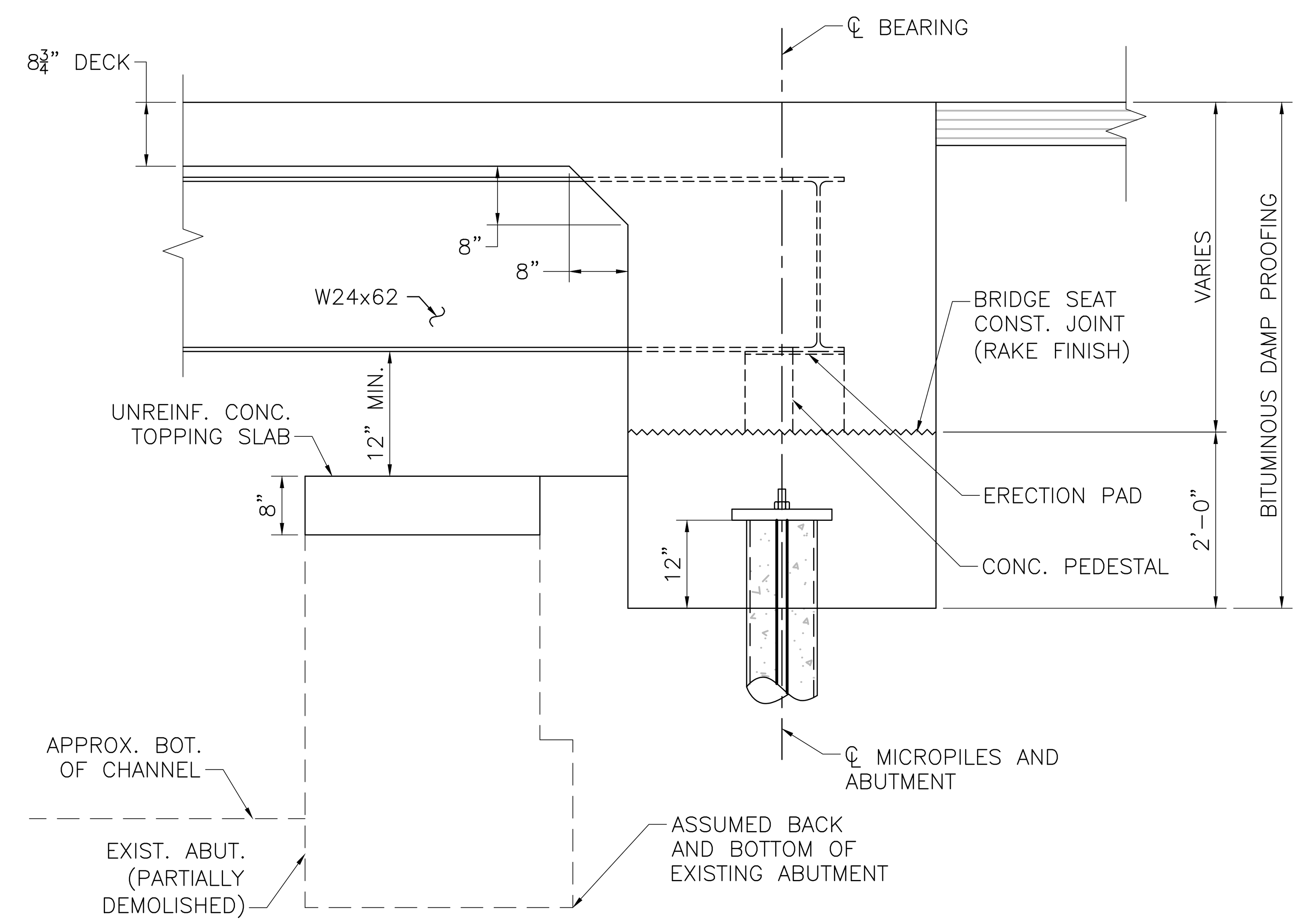
TYPICAL ABUTMENT PLAN
SCALE: ¼" = 1'-0"



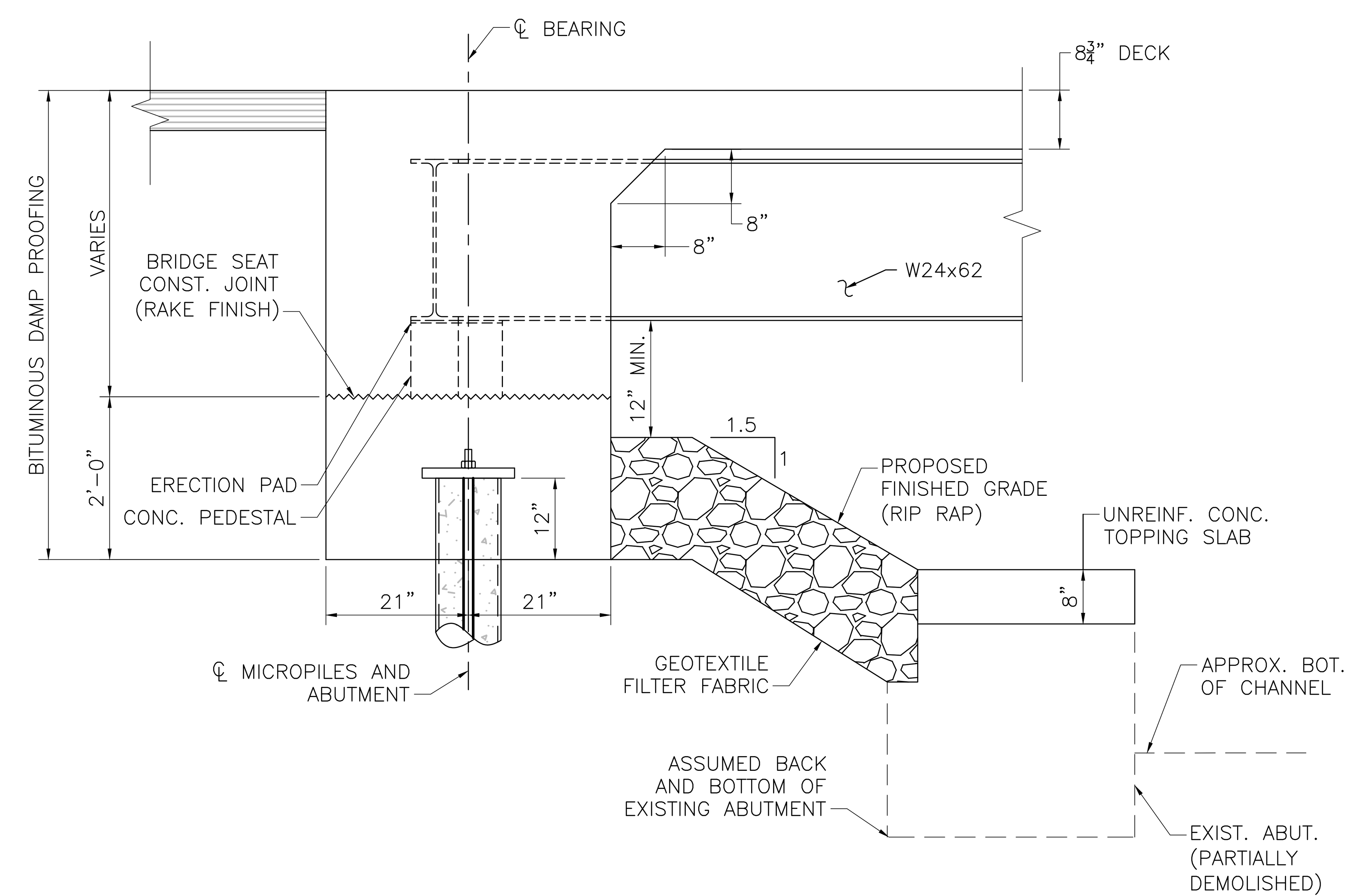
TYPICAL ABUTMENT ELEVATION
SCALE: ¼" = 1'-0"



TYPICAL FOUNDATION PLAN
SCALE: ¼" = 1'-0"



TYPICAL NORTH ABUTMENT SECTION
SCALE: ¾" = 1'-0"



TYPICAL SOUTH ABUTMENT SECTION
SCALE: ¾" = 1'-0"

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GILL ENGINEERING

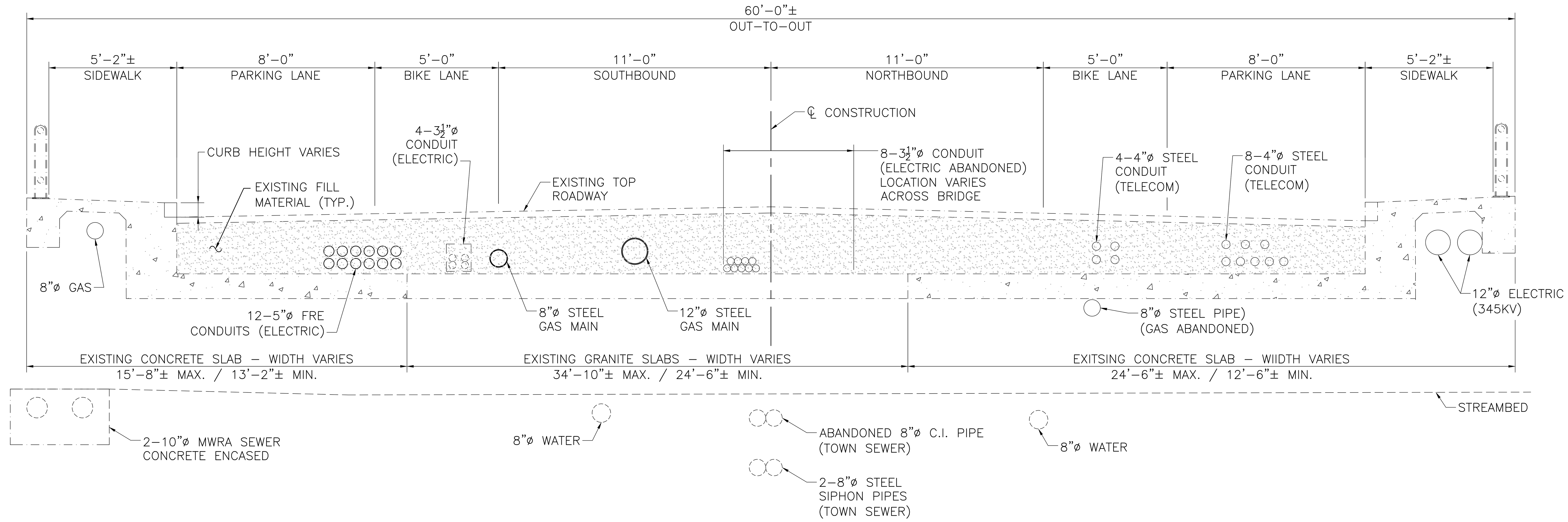
DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION

REGISTERED PROFESSIONAL ENGINEER
DATE

BRIDGE REPLACEMENT
TOWN OF ARLINGTON
PROPOSED BRIDGE REPLACEMENT
A-10-015 (7XF)
US3 (MYSTIC STREET) OVER MILL BROOK

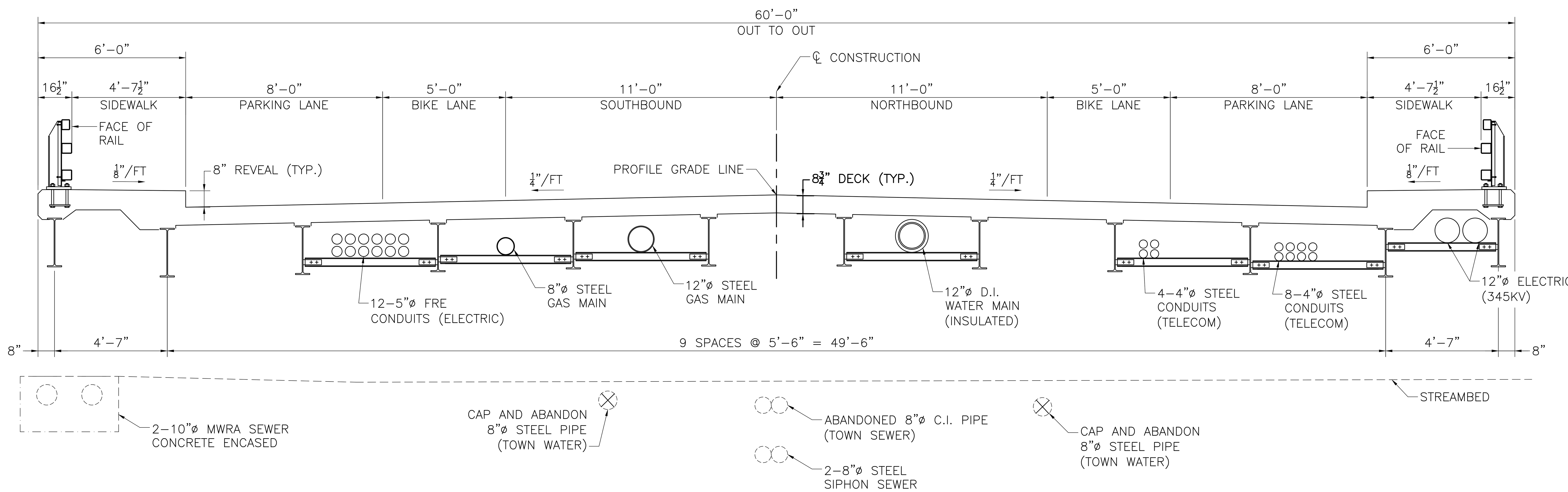
ABUTMENT DETAILS

SHEET 4 OF 10



EXISTING CROSS SECTION

SCALE: ⅜" = 1'-0"



PROPOSED CROSS SECTION

SCALE: ⅜" = 1'-0"

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DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION

REGISTERED PROFESSIONAL ENGINEER

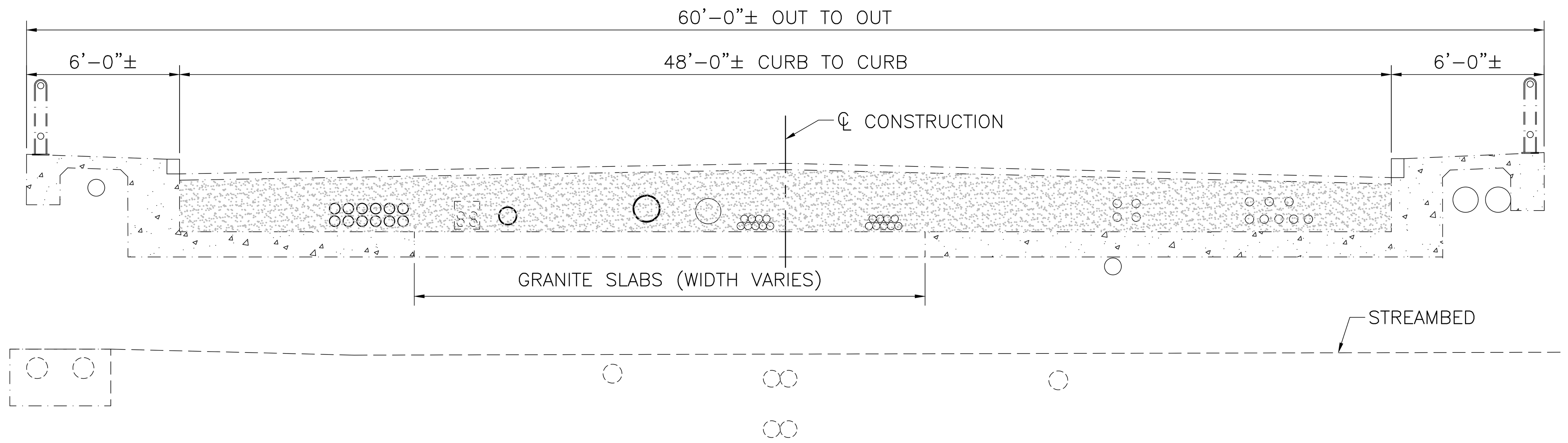
DATE

BRIDGE REPLACEMENT
TOWN OF ARLINGTON

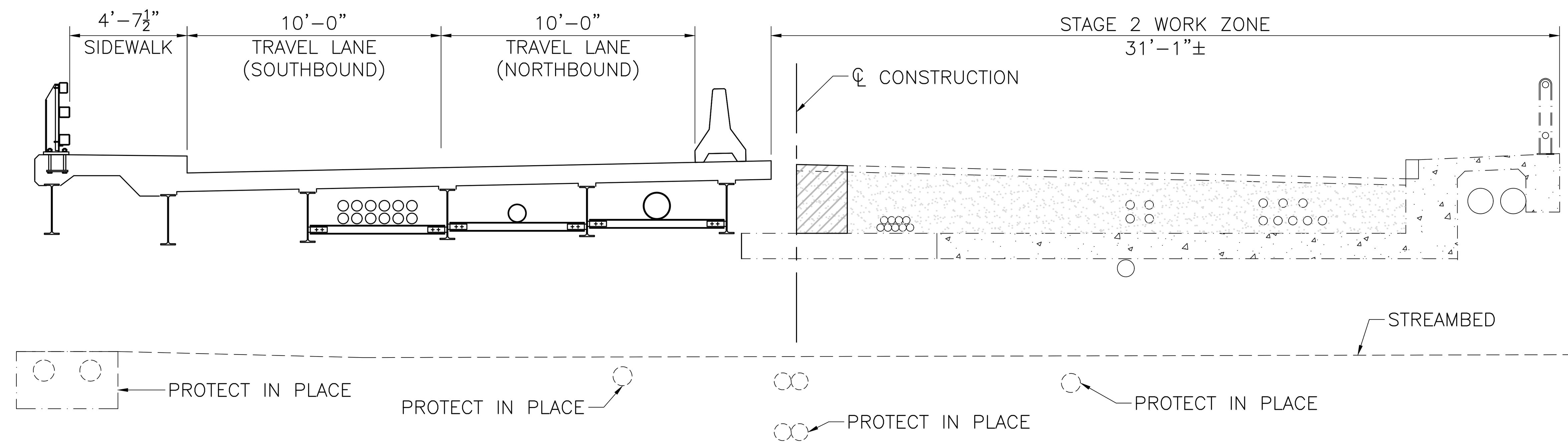
PROPOSED BRIDGE REPLACEMENT
A-10-015 (7XF)
US3 (MYSTIC STREET) OVER MILL BROOK

EXISTING & PROPOSED SECTION

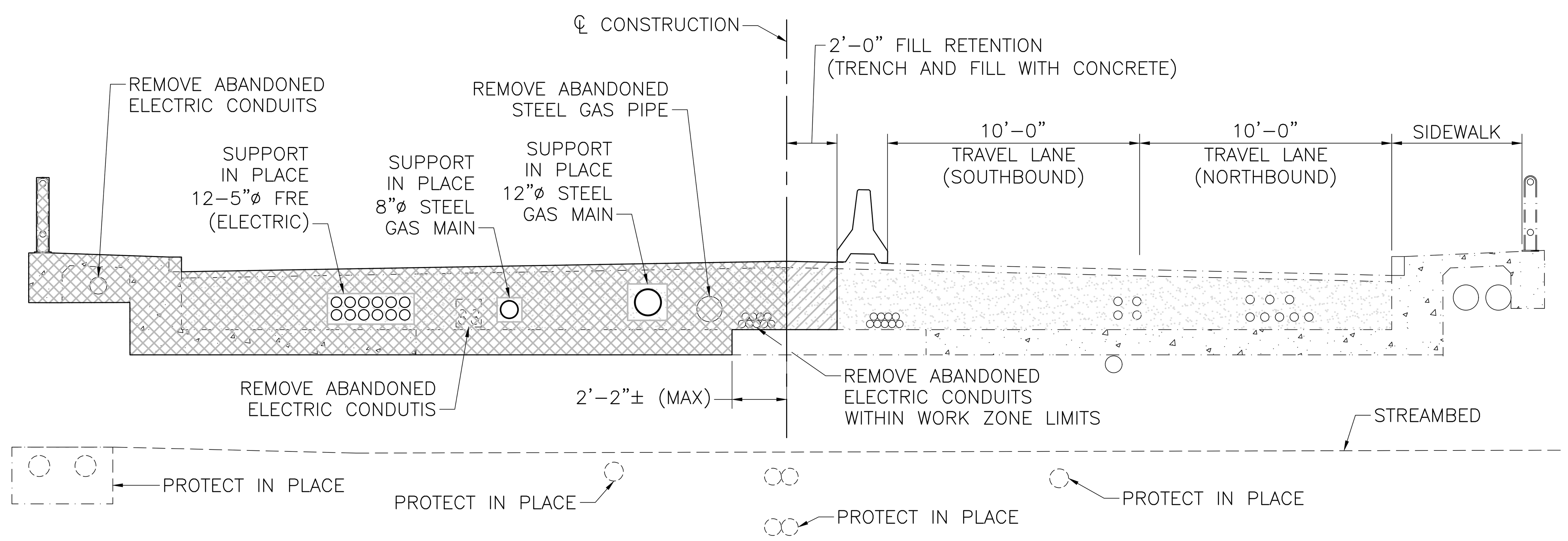
SHEET 5 OF 10



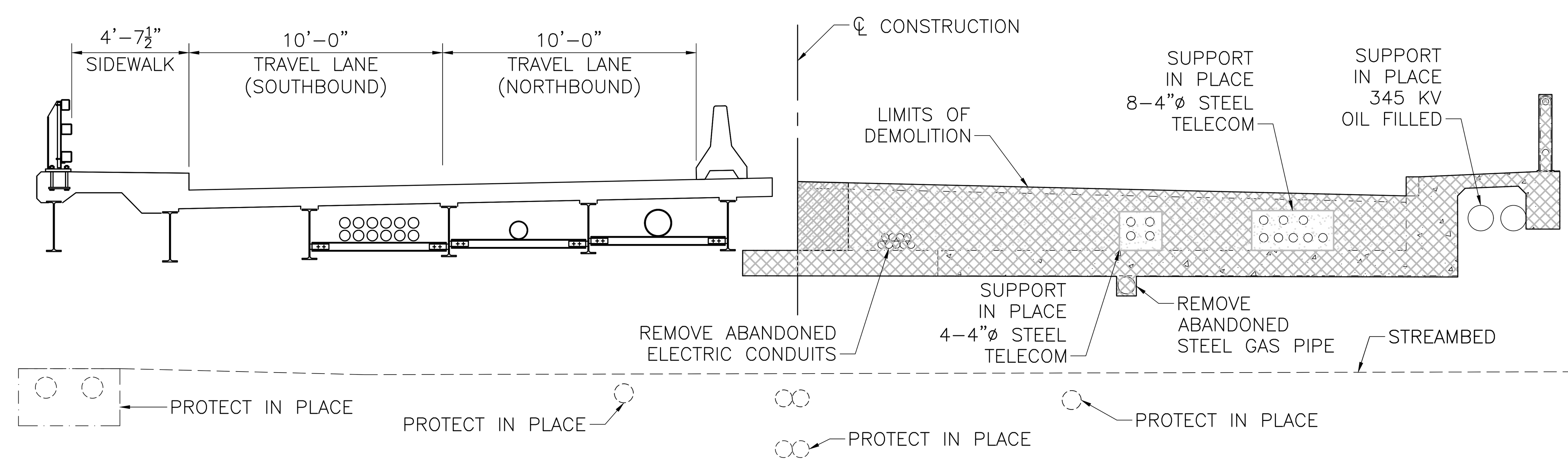
EXISTING



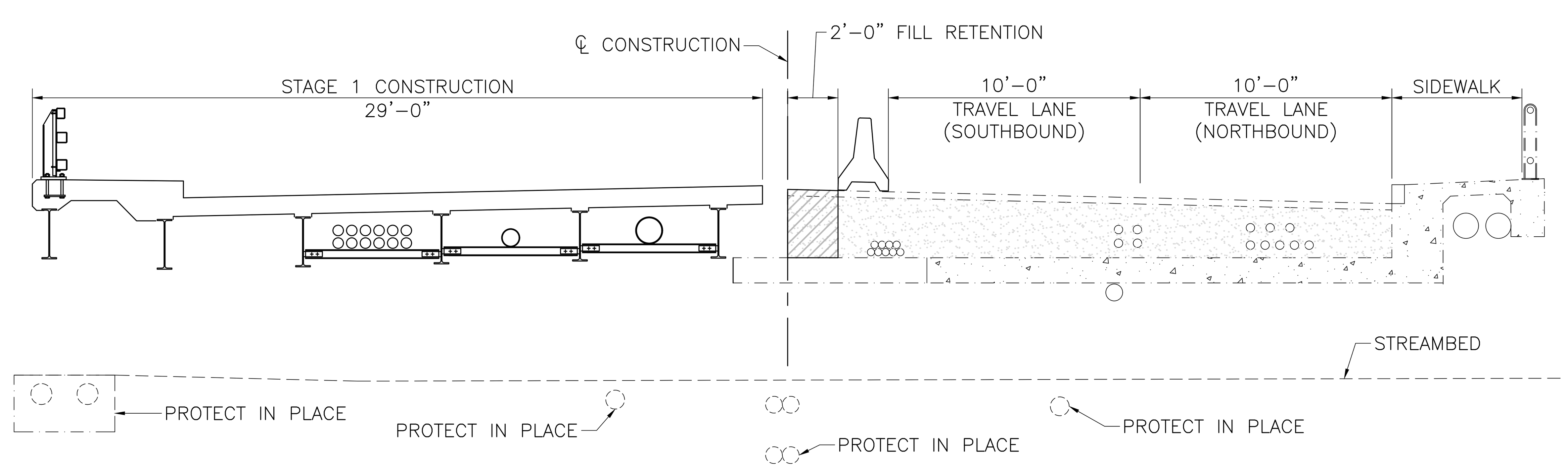
STAGE 2



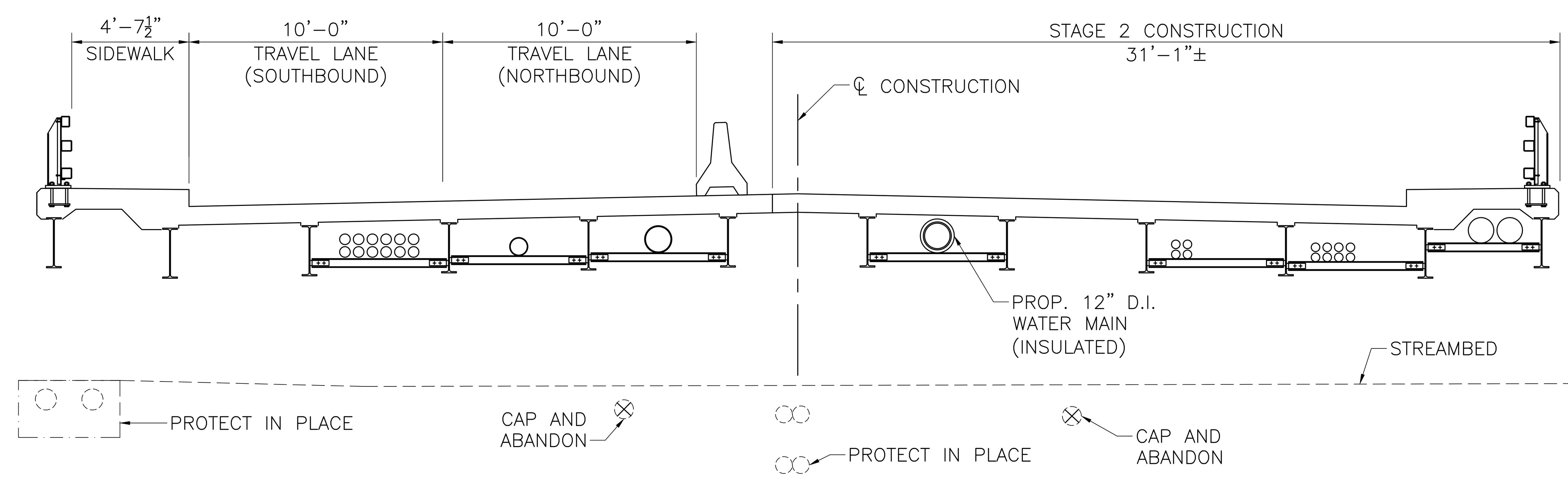
STAGE 1 – DEMOLITION



STAGE 2 – DEMOLITION



STAGE 1 – CONSTRUCTION



STAGE 2 – CONSTRUCTION

CONSTRUCTION STAGING

SCALE: ¼" = 1'-0"

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DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION

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DATE

BRIDGE REPLACEMENT
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (7XF)
US3 (MYSTIC STREET) OVER MILL BROOK

CONSTR. STAGING

SHEET 6 OF 10

APPENDIX

5.5. Preliminary Design Calculations

PROPOSED LOADS A-10-015 (7XF)

References
(1) AASHTO LRFD Bridge Design, 7th Edition, 2014 (thru 2016 interims)
(2) MASSDOT LRFD Bridge Design Guidelines

Proposed Dead Loads

Superstructure Dead loads

Bridge Length = 35.83 ft

	Width (ft)	Thick. (ft)	Area (ft^2)	Length (ft)	Unit Weight (kcf/klf)	Quantity	Load (kips)	
Beam (W24x62)	-	-	-	32.33	0.062	11	22.05	
Diaphragm	-	-	-	35.83	0.025	10	8.96	
Haunch	0.59	0.13	0.07	35.83	0.150	11	4.34	
Utility	-	-	-	35.83	0.150	7	37.63	
Deck	48.00	0.73	35.00	35.83	0.150	1	188.13	
1st Int. Beam Overhang	2.33	0.82	1.92	35.83	0.150	2	20.64	
Exterior Beam Overhang	1.33	0.50	0.67	35.83	0.150	2	7.17	
Sidewalk	6.00	0.69	4.14	35.83	0.150	2	44.55	
S3-TL4 Railing	-	-	-	35.83	0.090	2	6.45	
						Total Sup. DC =	339.91	kips
						Total Sup. DC Reactions =	169.954	kips

	Width (ft)	Thick. (ft)	Area (ft^2)	Length (ft)	Unit Weight (kcf/klf)	Quantity	Load (kips)	
Wearing Surface	0.00	0.00	0.00	35.83	0.150	1	0.00	
						DW Reactions =	0.00	kips

Substructure Dead Loads

Substructure Length = 62.15 ft

	Width (ft)	Height (ft)	Area (ft^2)	Length (ft)	Unit Weight (kcf/klf)	Quantity	Load (kips)	
Integral Abut.	3.50	2.60	9.11	62.15	0.150	2	169.93	
Integral Abut. Chamfer	0.67	0.67	0.22	62.15	0.150	2	4.14	
Footing	3.50	3.27	11.45	62.15	0.150	2	213.43	
Micropiles (API N-80)	-	-	-	30.00	0.047	20	28.20	
						Total Sub. DC =	415.71	kips
						Total Sub. DC Reactions (kips) =	207.85	kips

PROPOSED LOADS A-10-015 (7XF)

Live Loads

Roadway Width =	48.00	ft	
Sidewalk Width (from railing face) =	9.25	(Both Sides)	

Case 1 (Pedestrian ignored, travel width = out-to-out of bridge)

No. Lanes =	4.00		
m =	0.65		(2) 3.10.2.2
Span Length =	32.33	ft	

HL 93 Truck Loading

Lane Load =	0.640	klf	(1) 3.6.1.2.4
Total Lane Load =	1.664	klf	
Total Lane Load Reactions =	26.9013	kips	
HS20 Truck Reactions =	51.00	kips	AASHTO Stand. Specs. App. A
IM =	1.00		(2) 3.10.2.2
Total HS20 Truck Reactions =	132.60	kips	
Total LL End Reactions =	159.50	kips	

Case 2 (Pedestrian inluded, travel width = curb-to-curb of bridge)

No. Lanes =	4.00		
m =	0.65		
Span Length =	32.33	ft	

HL 93 Truck Loading

Lane Load =	0.640	klf	(1) 3.6.1.2.4
Total Lane Load =	1.664	klf	
Total Lane Load Reactions =	26.9013	kips	
HS20 Truck Reactions =	51.00	kips	AASHTO Stand. Specs. App. A
IM =	1.00		(2) 3.10.2.2
Total HS20 Truck Reactions =	132.60	kips	

Pedestrian Live Loads

Pedestrian Load =	0.075	ksf	(1) 3.6.1.6
Sidewalk Width =	6.00	ft	
Quantity =	2.00		
Pedestrain Reactions =	14.55	kips	
Total LL End Reactions =	174.05	kips	

PROPOSED LOADS A-10-015 (7XF)

Total Loading (Vertical Loads)

Factors are per AASHTO LRFD Bridge Design, 7th Edition, 2014 (thru 2016 interims), Table 3.4.1-1 & 3.4.1-2

	Load (kips)	γ	Importance Factor	γ*Load (kips)	γ	γ*Load (kips)	
DC (Superstructure) =	169.95	1.25	1.05	223.06	1.00	178.45	
DW =	0.00	1.50	1.05	0.00	1.00	0.00	
DC (Substructure) =	207.85	1.25	1.05	272.81	1.00	203.44	(no pile selfweight)
EV =	0.00	1.00	1.05	0.00	1.00	0.00	
LL =	174.05	1.75	1.05	319.82	1.00	182.75	
Total =	551.86			815.69		564.65	

PROPOSED MICROPILES GEOTECHNICAL RESISTANCE — A-10-015 (7XF)

References:
(1) AASHTO LRFD Bridge Design, 7th Edition, 2014 (thru 2016 interims)

Axial Compression Resistance

$R_C = \phi_C R_n = \phi_{qp} R_p + \phi_{qs} R_s$ — (1) 10.9.3.5.1-1

in which $R_p = q_p A_p$

$R_s = q_s A_s$

where: R_p = Nominal tip resistance (kips)

R_s = Nominal grout-to-ground resistance (kips)

ϕ_{qp} = Resistance factor for tip resistance

ϕ_{qs} = Resistance factor for grout-to-ground bond resistance

q_p = Unit tip resistance (ksf)

q_s = Unit grout-to-ground resistance (ksf)

A_p = Area of micropile tip (ft^2)

A_s = Area of grout-to-ground bond surface (ft^2)

$R_s = (\pi d_b a_b L_b)$ — (1) 10.9.3.5.2-1

Grout-to-Ground Resistance

D_{casing} =	9.625	in	(API - N80)	
t_{casing} =	0.435	in		
d_b =	8.755	in		
a_b =	5.00	ksf (Type B in Sand)		(1) Table C10.9.3.5.2-1
L_b =	15.00	ft		
R_s =	171.904	kips		
ϕ_{qs} =	0.55			(1) Table 10.5.5.2.5-1
$\phi_{qs} R_s$ =	94.55	kips		

Tip Resistance in Rock

Micropiles will be not be bearing on rock.

Group Efficiency

η = 1.00 (piles in cohesionless soil) — (1) 10.7.3.9

Micropile Group Compression Resistance

Number of Piles, N_b =	10	
$\eta \phi_{qs} R_s$ =	94.55	kips
Total $\eta \phi_{qs} R_s$ =	945.5	kips
ϕP_u =	815.69	kips
F.S. =	1.16	

PROPOSED MICROPILES STRUCTURAL RESISTANCE — A-10-015 (7XF)

References:
(1) AASHTO LRFD Bridge Design, 7th Edition, 2014 (thru 2016 interims)

Axial Compressive Resistance

$R_C = \phi_C R_n$ — (1) 10.9.3.10.2-1

where: ϕ_C = Resistance factor for structural resistance of micropiles in axial compression

R_n = nominal axial compression resistance of micropile (kips)

ϕ_{CC} = 0.75 — (1) 10.5.5.2.5-2

ϕ_{CU} = 0.75 — (1) 10.5.5.2.5-2

Cased Length

$R_{CC} = \phi_{CC} R_n$ — (1) 10.9.3.10.2a-1

$R_n = 0.85[0.85f'_c A_g + f_y(A_b + A_c)]$ — (1) 10.9.3.10.2a-2

D_{casing} = 9.63 in (API N-80 Pipe)
t_{casing} = 0.435 in
A_c = 12.56 in^2

D_{rebar} = #11 = 1.41 in
$A_b = A_{rebar}$ = 1.56 in^2

f'_c = 4.00 ksi
D_{grout} = 7.35 in
$A_g = A_{grout}$ = 42.37 in^2

f_{y_Casing} = 80.00 ksi
f_{y_Rebar} = 75.00 ksi
E = 29000 ksi
0.003E = 87.00 ksi
Use min f_y = 75.00 ksi

R_n = 1023 kips
$\phi_{CC} R_n$ = 767 kips

Uncased Length

$R_{CU} = \phi_{CU} R_n$ — (1) 10.9.3.10.2b-1

$R_n = 0.85[0.85f'_c A_g + f_y A_b]$ — (1) 10.9.3.10.2b-2

A_b = 1.56 in^2
f'_c = 4.00 ksi
$A_g = A_{grout}$ = 42.37 in^2

PROPOSED MICROPILES STRUCTURAL RESISTANCE — A-10-015 (7XF)

References:
(1) AASHTO LRFD Bridge Design, 7th Edition, 2014 (thru 2016 interims)

f_{y_Rebar} = 75.00 ksi
0.003E = 87.00 ksi
Use min f_y = 42.37 ksi

R_{CU} = 179 kips
$\phi_{CU}R_n$ = 134 kips

Axial Tension Resistance

$R_T = \phi_T Rn$ — (1) 10.9.3.10.2-1
where: ϕ_T = Resistance factor for structural resistance of micropiles in axial tension
R_n = nominal axial tension resistance of micropile (kips)

ϕ_{TC} = 0.80 — (1) 10.5.5.2.5-2
ϕ_{TU} = 0.80 — (1) 10.5.5.2.5-2

Cased Length

$R_{TC} = \phi_{TC}R_n$ — (1) 10.9.3.10.3a-1
$R_n = f_y(A_b+A_{ct})$ — (1) 10.9.3.10.3a-2

A_c = 12.56 in^2
$A_b = A_{rebar}$ = 1.56 in^2

f_{y_Casing} = 80.00 ksi
f_{y_Rebar} = 75.00 ksi
Use min f_y = 75.00 ksi

R_n = 1059.0 kips
$\phi_{TC}R_n$ = 847.226 kips

Uncased Length

$R_{TU} = \phi_{TU}R_n$ — (1) 10.9.3.10.3b-1
$R_n = f_yA_b$ — (1) 10.9.3.10.3b-2

Use $f_y = f_{y\_Rebar}$ = 75.00 ksi
$A_b = A_{rebar}$ = 1.56 in^2
R_n = 117.11 kips
$\phi_{TU}R_n$ = 93.69 kips

PROPOSED MICROPILES STRUCTURAL RESISTANCE — A-10-015 (7XF)

References:
(1) AASHTO LRFD Bridge Design, 7th Edition, 2014 (thru 2016 interims)

Plunge Length Transfer Load

$P_T = \phi(\pi d_b a_b L_p)$ — (1) 10.9.3.10.4-1

$\phi = \phi_{stat} =$ 0.55 — (1) Table 10.5.5.2.5-1
$d_b =$ 8.76 in
$a_b =$ 5.00 ksf (Type B in Sand) — (1) Table C10.9.3.5.2-1
$L_p =$ 1.00 ft

$\phi P_T =$ 6.30 kips

Structural Capacity Summary

	Compression		Tension	
	$\phi_{CC}R_n$ (kips)	$\phi_{CU}R_n$ (kips)	$\phi_{TC}R_n$ (kips)	$\phi_{TU}R_n$ (kips)
Number of Piles, N_b =	10	10	10	10
ϕP_u (kips) =	815.69	815.69	815.69	815.69
ϕP_u per pile (kips) =	81.57	81.57	81.57	81.57
ϕP_T (kips) =	0.00	6.30	0.00	6.30
Pile Resistance =	766.97	134.02	847.23	93.69
F.S. =	9.40	1.78	10.39	1.24

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63 KENDRICK STREET, NEEDHAM, MA 02494

PROPOSED MICROPILES COMBINED COMPRESSION & FLEXURE CHECK — A-10-015 (7XF)

References:
(1) AASHTO LRFD Bridge Design, 7th Edition, 2014 (thru 2016 interims)

Combined Axial Compression and Flexure

P_u =	81.57	kips (per pile)	See Structural Cap Calcs
P_r =	766.97	kips (per pile)	See Structural Cap Calcs
M_u =	202.62	k-in (per pile)	Lpile Outputs

Factored Flexure Resistance

M_r =	$\phi_f M_n$		
ϕ_f =	1.00		(1) 6.5.4.2
D =	9.63	in	
t =	0.44	in	
E =	29000	ksi	
F_y =	80.00	ksi	

For $D/t < 2\sqrt{E/F_y}$ — $M_n = M_{ps}$ — (1) 6.12.2.3.2-1

For $2\sqrt{E/F_y} < D/t \le 8.8\sqrt{E/F_y}$ — $M_n = M_{yc}$ — (1) 6.12.2.3.2-2

D/t =	22.13	
$2\sqrt{E/F_y}$ =	38.08	
$8.8\sqrt{E/F_y}$ =	167.55	
Use M_n =	Mps	
F_u =	100	ksi
Z =	36.77	in^3
$\phi_f M_r$ =	3677	k-in (per pile)

For $P_u/P_r < 0.2$ — (1) 6.9.2.2-1

$$\frac{P_u}{2.0P_r} + \frac{(M_{ux}}{(M_{rx}} + \frac{M_{uy})}{M_{ry})} \le 1.00$$

For $P_u/P_r \ge 0.2$ — (1) 6.9.2.2-2

$$\frac{P_u}{P_r} + \frac{8.00}{9.00}\frac{(M_{ux}}{(M_{rx}} + \frac{M_{uy})}{M_{ry})} \le 1.00$$

P_u/P_r = 0.11

Then

$$\frac{82}{1534} + \frac{(203}{(3677} + \frac{203)}{3677)} \le 0.11$$

SETTLEMENT — A-10-015 (7XF)

References:
(1) AASHTO LRFD Bridge Design, 7th Edition, 2014 (thru 2016 interims)

Footing Gemoetry & Loading

D_f =	6.604	ft (from roadway)	
B =	0.80	ft	
L =	50.52	ft	
Pile Depth = D =	30.00	ft	
D' = 2/3D =	20.00	ft	
B_1 =	10.80	ft (1H:4V)	(1) Figure 10.7.2.3.1-1
L_1 =	60.52	ft (1H:4V)	(1) Figure 10.7.2.3.1-1

Pile Group Settlement in Cohesionless soils

Per 10.7.2.3.2 other methods for computing settlement in cohesionless soil such as the hough method as specified in Article 10.6.2.4.2 may also be used in connection with the equivalent footing approach.

	Layer 1	Layer 2		
γ =	0.120	0.120	kcf	
Start =	20.00	25.00	ft	
End =	25.00	30.00	ft	
H_c =	5.00	5.00	ft	
Ground elevation to $H_c/2$ =	29.10	36.60	ft	
h_{water} =	0.00	0.00	ft	Assumed at ground level
h_1 (above water) =	0.00	0.00	ft	
h_2 (below water) =	29.10	36.60	ft	
σ'_o =	1.68	2.11	ksf	
P_u =	564.65	564.65	kips	
z =	2.50	7.50	ft	
B_1 =	13.30	18.30	ft (1H:2V)	(1) Figure 10.7.2.3.1-1
L_1 =	63.02	68.02	ft (1H:2V)	(1) Figure 10.7.2.3.1-1
$\Delta\sigma_v = q_u = P_u/B_1L_1$ =	0.67	0.45	ksf	
$\sigma'_o + \Delta\sigma'_v$ =	2.35	2.56	ksf	
N_{160} =	24	32		See Soil Properties Calcs
C' =	85	110		(1) Figure 10.6.2.4.2-1
ΔH =	0.104	0.046	in	

Total Settlement = 0.150 in

The required cased length of the microplie was determined using Lpile.
The soil profile is defined in LPile as two layers with the following properties:

Upper Layer: Medium sand layer from 0 ft. to 6 ft. with friction angle of 32 degrees.

Lower Layer: Medium dense sand layer from 6 ft. to 30 ft. with a friction agle of 34 degrees.

Lateral loads from 10 kips to 100 kips (Case 1 to Case 10) were applied to the pile head with no axial loads, and pile-head deflections were generated for different cased lengths to check the pile critical length.
Assuming a maximum of 0.25 inches of thermal movement, it was determine that a cased length of 15 feet would be adequate.

==

LPile Plus for Windows, Version 6 (6.0.22)

Analysis of Individual Piles and Drilled Shafts

Subjected to Lateral Loading Using the p-y Method

==

This program is licensed to:

Gill Engineering Associates

Needham, MA

Files Used for Analysis

Path to file locations: \\GILLSERVER\Dropbox\Arlington A10015\Calculations\FB\LPile\

Name of input data file: A10015 - Micropiles - Lcritical.lp6d

Name of output report file: A10015 - Micropiles - Lcritical.lp6o

Name of plot output file: A10015 - Micropiles - Lcritical.lp6p

Name of runtime messeage file: A10015 - Micropiles - Lcritical.lp6r

----

Date and Time of Analysis

Date: December 20, 2017 Time: 12:16:45

Problem Title

Project Name: Arlington

Job Number: A-10-015 (7XF)

Client: Town of Arlington

Engineer: FB

Description: Micropiles

Program Options

Engineering units are US Customary Units: pounds, inches, feet

Basic Program Options:

This analysis computes nonlinear bending stiffness and nominal moment

capacity with pile response computed using nonlinear EI

Computation Options:

- Only internally-generated p-y curves used in analysis
- Analysis does not use p-y multipliers (individual pile or shaft action only)
- Analysis assumes no shear resistance at pile tip
- Analysis for fixed-length pile or shaft only
- No computation of foundation stiffness matrix elements
- Output pile response for full length of pile
- Analysis assumes no soil movements acting on pile
- No p-y curves to be computed and output for user-specified depths

Solution Control Parameters:

- Number of pile increments = 100
- Maximum number of iterations allowed = 100
- Deflection tolerance for convergence = 1.0000E-05 in
- Maximum allowable deflection = 100.0000 in

Pile Response Output Options:

- Values of pile-head deflection, bending moment, shear force, and
  soil reaction are printed for full length of pile.
- Printing Increment (nodal spacing of output points) = 1

Pile Structural Properties and Geometry

Total Number of Sections = 2

Total Pile Length = 30.00 ft

Depth of ground surface below top of pile = -11.00 ft

Slope angle of ground surface = 0.00 deg.

Pile dimensions used for p-y curve computations defined using 4 points.

p-y curves are computed using values of pile diameter interpolated over

the length of the pile.

Point	Depth X ft	Pile Diameter in
1	0.00000	9.6250000
2	15.000000	9.6250000
3	15.000000	8.6810000
4	30.000000	8.6810000

Input Structural Properties:

Pile Section No. 1:

Section Type = Drilled Shaft with Permanent Casing

Section Length = 15.000 ft

Pile Width = 9.625 in

Pile Section No. 2:

Section Type = Drilled Shaft (Bored Pile)

Section Length = 15.000 ft

Section Diameter = 8.681 in

Ground Slope and Pile Batter Angles

Ground Slope Angle = 0.000 degrees

= 0.000 radians

Pile Batter Angle = 0.000 degrees

= 0.000 radians

Soil and Rock Layering Information

The soil profile is modelled using 2 layers

Layer 1 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = -11.000 ft

Distance from top of pile to bottom of layer = -5.000 ft

p-y subgrade modulus k for top of soil layer = 20.000 lbs/in**3

p-y subgrade modulus k for bottom of layer = 20.000 lbs/in**3

Layer 2 is sand, p-y criteria by Reese et al., 1974

Distance from top of pile to top of layer = -5.000 ft

Distance from top of pile to bottom of layer = 35.000 ft

p-y subgrade modulus k for top of soil layer = 60.000 lbs/in**3

p-y subgrade modulus k for bottom of layer = 60.000 lbs/in**3

(Depth of lowest layer extends 5.00 ft below pile tip)

Effective Unit Weight of Soil vs. Depth

Effective unit weight of soil with depth defined using 4 points

Point No.	Depth X ft	Eff. Unit Weight pcf
1	-11.00	57.60000
2	-5.00	57.60000
3	-5.00	57.60000
4	35.00	57.60000

Summary of Soil Properties

Layer Num.	Soil Type (p-y Curve Criteria)	Depth ft	Eff. Unit Wt., pcf	Cohesion psf	Friction Ang., deg.	qu psi	RQD percent	Epsilon 50	kpy pci	Rock Emass psi	krm	Test Type	Test Prop.	Elas. Subgr. pci
1	Sand (Reese, et al.)	-11.000	57.600	--	32.000	--	--	--	20.000	--	--	--	--	--
		-5.000	57.600	--	32.000	--	--	--	20.000	--	--	--	--	--
2	Sand (Reese, et al.)	-5.000	57.600	--	34.000	--	--	--	60.000	--	--	--	--	--
		35.000	57.600	--	34.000	--	--	--	60.000	--	--	--	--	--

Loading Type

Static loading criteria were used when computing p-y curves for all analyses.

Pile-head Loading and Pile-head Fixity Conditions

Number of loads specified = 10

Load No.	Load Type	Condition 1	Condition 2	Axial Thrust Force, lbs
1	2	V = 10000.000 lbs	S = 0.000 in/in	0.000
2	2	V = 20000.000 lbs	S = 0.000 in/in	0.000
3	2	V = 30000.000 lbs	S = 0.000 in/in	0.000
4	2	V = 40000.000 lbs	S = 0.000 in/in	0.000
5	2	V = 50000.000 lbs	S = 0.000 in/in	0.000

6	2	V =	60000.000 lbs	S =	0.000	in/in	0.000
7	2	V =	70000.000 lbs	S =	0.000	in/in	0.000
8	2	V =	80000.000 lbs	S =	0.000	in/in	0.000
9	2	V =	90000.000 lbs	S =	0.000	in/in	0.000
10	2	V =	100000.000 lbs	S =	0.000	in/in	0.000

V = perpendicular shear force applied to pile head

M = bending moment applied to pile head

y = lateral deflection relative to pile axis

S = pile slope relative to original pile batter angle

R = rotational stiffness applie to pile head

Axial thrust is assumed to be acting axially

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 1

Moment values interpolated at maximum compressive strain = 0.003

or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	0.000	2824.132	0.00300000

Note note that the values of moment capacity in the table above are not

factored by a strength reduction factor (phi-factor).

In ACI 318-08, the value of the strength reduction factor depends on whether

the transverse reinforcing steel bars are spirals or tied hoops.

The above values should be multiplied by the appropriate strength reduction

factor to compute ultimate moment capacity according to ACI 318-08, Section

9.3.2.2 or the value required by the design standard being followed

----

Summary of Results for Nominal (Unfactored) Moment Capacity for Section 2

Moment values interpolated at maximum compressive strain = 0.003

or maximum developed moment if pile fails at smaller strains.

Load No.	Axial Thrust kips	Nominal Mom. Cap. in-kip	Max. Comp. Strain
1	0.000	159.441	0.00300000

Note note that the values of moment capacity in the table above are not

factored by a strength reduction factor (phi-factor).

In ACI 318-08, the value of the strength reduction factor depends on whether

the transverse reinforcing steel bars are spirals or tied hoops.

The above values should be multiplied by the appropriate strength reduction

factor to compute ultimate moment capacity according to ACI 318-08, Section

9.3.2.2 or the value required by the design standard being followed.

Summary of Pile Response(s)

Definitions of Pile-head Loading Conditions:

Load Type 1: Load 1 = Shear, lbs, and Load 2 = Moment, in-lbs

Load Type 2: Load 1 = Shear, lbs, and Load 2 = Slope, radians

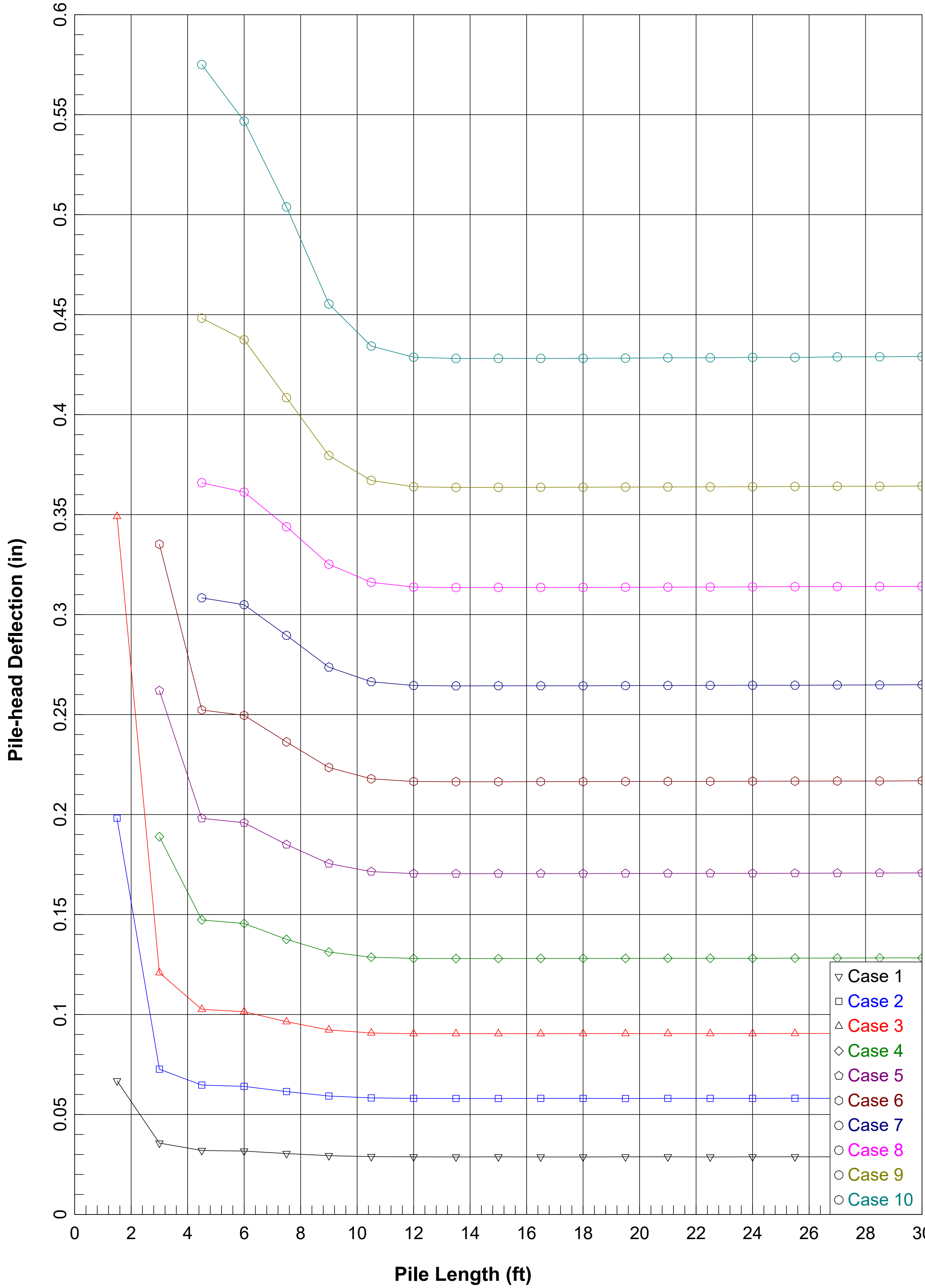
Load Type 3: Load 1 = Shear, lbs, and Load 2 = Rotational Stiffness, in-lbs/radian

Load Type 4: Load 1 = Top Deflection, inches, and Load 2 = Moment, in-lbs

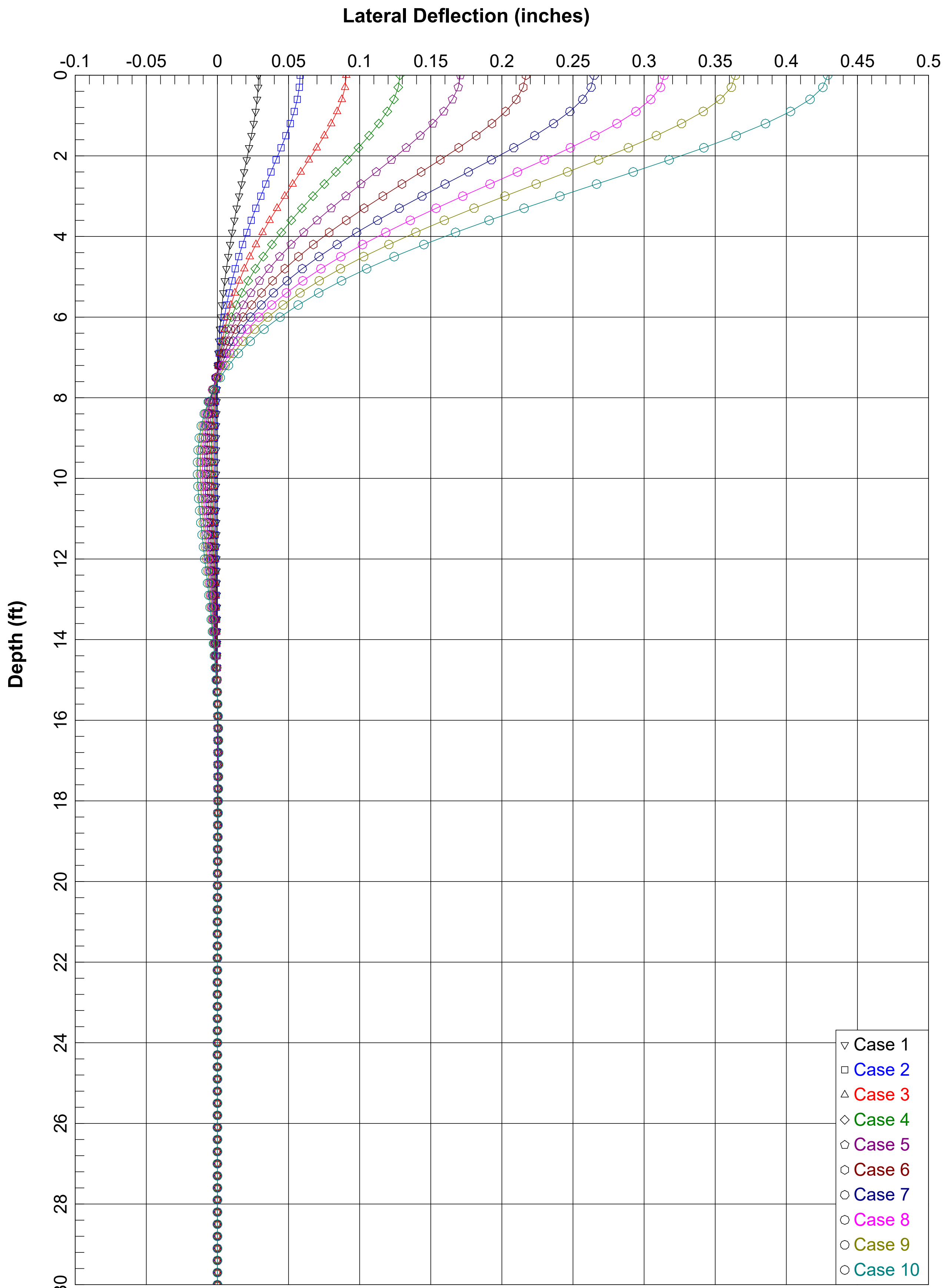
Load Type 5: Load 1 = Top Deflection, inches, and Load 2 = Slope, radians

Load Case No.	Load Type No.	Pile-head Condition 1 V(lbs) or y(inches)	Pile-head Condition 2 in-lb, rad., or in-lb/rad.	Axial Loading lbs	Pile-head Deflection inches	Maximum Moment in-lbs	Maximum Shear lbs	Pile-head Rotation radians

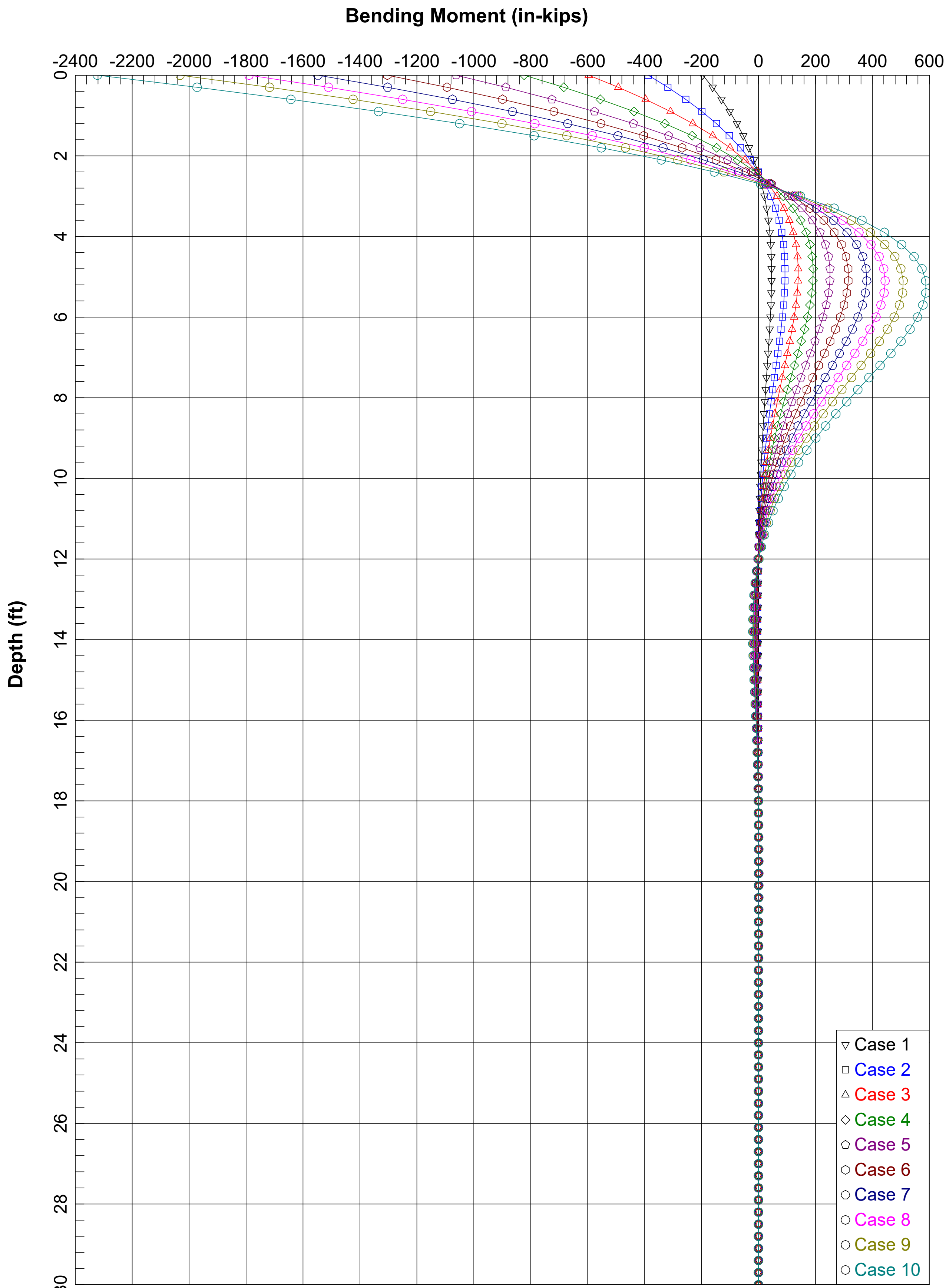
```
---- ---- -------------- -------------- ------------- ------------- ------------- ------------- -------------
 1   2  V = 10000.0000  S =    0.000    0.0000000   0.02890006    -195952.    10000. 0.00000000
 2   2  V =    20000.  S =    0.000    0.0000000   0.05814088    -387547.     20000.   0.00000000
 3   2  V =    30000.  S =    0.000    0.0000000   0.09060664    -596443.     30000.   0.00000000
 4   2  V =    40000.  S =    0.000    0.0000000   0.12830762    -823466.     40000.   0.00000000
 5   2  V =    50000.  S =    0.000    0.0000000   0.17080153    -1062059.     50000.   0.00000000
 6   2  V =    60000.  S =    0.000    0.0000000   0.21689211    -1303562.     60000.   0.00000000
 7   2  V =    70000.  S =    0.000    0.0000000   0.26492025    -1547350.     70000.   0.00000000
 8   2  V =    80000.  S =    0.000    0.0000000   0.31412432    -1789756.     80000.   0.00000000
 9   2  V =    90000.  S =    0.000    0.0000000   0.36428254    -2031828.     90000.   0.00000000
10   2  V =   100000.  S =    0.000    0.0000000   0.42904187    -2322279.     100000.   0.00000000
The analysis ended normally.
```



Pile-head Deflection (in)
Pile Length (ft)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
0.6
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Case 8
Case 9
Case 10



Lateral Deflection (inches)
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Case 8
Case 9
Case 10


Bending Moment (in-kips)
-2400
-2200
-2000
-1800
-1600
-1400
-1200
-1000
-800
-600
-400
-200
0
200
400
600
Depth (ft)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
Case 1
Case 2
Case 3
Case 4
Case 5
Case 6
Case 7
Case 8
Case 9
Case 10

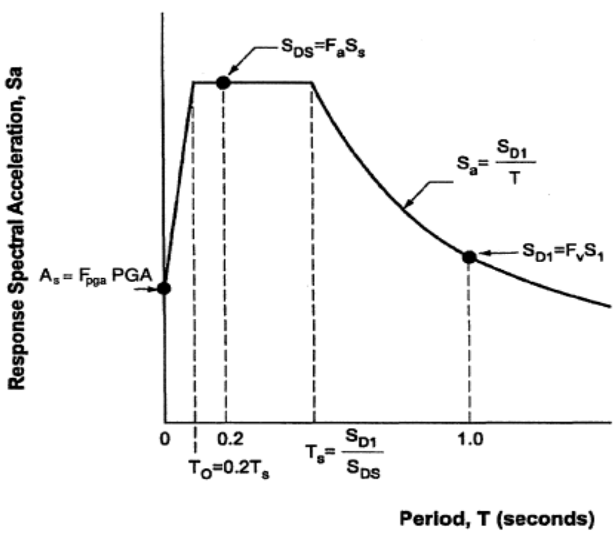
CLIENT	TOWN OF EASTON	PAGE ___ OF ___
PROJECT	SOUTH STREET CULVERT	CALC BY KTN
BRIDGE NO.	W-06-025 (951)	CHECK BY
SUBJECT	PRELIM DESIGN CALCS	DATE DEC 2017

GILL ENGINEERING

Develop Response Spectrum for Mystic Street, Arlington, MA - 2500 Year Return Event

Reference:
1. 2011 AASHTO Guide Specifications, LRFD Seismic Bridge Design, Interims Through 2015

Soil Site Class =	D	Stiff soil, 15<N<50 blows/ft	*Ref 1-Table 3.4.2.1-1*
PGA: Peak Ground Acceleration =	0.15		*Ref 1-Figure 3.4.1-2b*
S_S: Spectral Accel at T=0.2 sec =	0.25		*Ref 1-Figure 3.4.1-3b*
S_1: Spectral Accel at T=1.0 sec =	0.075		*Ref 1-Figure 3.4.1-4b*
$F_{pga}=F_a$: Site Coefficient at T=0.2 sec =	1.6		*Ref 1-Table 3.4.2.3-1*
F_v: Site Coefficient at T=1.0 sec =	2.4		*Ref 1-Table 3.4.2.3-2*
$A_S= F_{pgs}$ x PGA=	0.240 G	Acceleration Coefficient	
$S_{DS}=F_a$ x S_s=	0.400 G	Spectral Coefficient at T=0.2 sec	
$S_{D1}=F_v$ x S_1=	0.180 G	Spectral Coefficient at T=1.0 sec	
SDC: Seismic Design Category =	B	SD_A > 0.15	*Ref 1-Table 3.5-1*
$T_S= SD_1 / SD_S$ =	0.45 Sec		
$T_O= 0.2 \times T_S$ =	0.09 Sec		



Ordinates for Plot of Spectral Accel Curve vs. Period

T	Sa
0.00 Sec	0.24 G
0.09 Sec	0.40 G
0.10 Sec	0.40 G
0.20 Sec	0.40 G
0.45 Sec	0.40 G
0.30 Sec	0.40 G
0.40 Sec	0.40 G
0.50 Sec	0.36 G
0.60 Sec	0.30 G
0.70 Sec	0.26 G
0.80 Sec	0.23 G
0.90 Sec	0.20 G
1.00 Sec	0.18 G
1.10 Sec	0.16 G
1.20 Sec	0.15 G

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REPORT

Hydraulic Design Report

December 2017

Mystic Street Bridge Replacement

Arlington, MA

Prepared for:
Town of Arlington

Prepared by:
Weston & Sampson

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1.0 INTRODUCTION

This report describes the hydraulic analysis and design for the Replacement of the Mystic Street Bridge (Bridge # A-10-015 (7XF). The Mystic Street Bridge over Mill Brook # 3 is located on Route 3 in Arlington, MA, approximately south of the Arlington Police/ Fire Departments (112 Mystic Street). Mill Brook #3 flows from west to east beneath the Mystic Street Bridge. Mill Brook continues to flow east and then north and discharges into Lower Mystic Lake. The section of Mystic Street that crosses over the bridge is oriented along a northwest to southeast alignment. The location map, included on Page 2, shows the bridge and the surrounding roadway configurations.

The bridge is located within the FEMA Flood Zone AE with a regulatory floodway, as shown on the FEMA FIRM Map FM 25017C0417E. The bridge is located between the FEMA cross sections E and F. A copy of FEMA Map is included in Appendix A.

The existing 2-span bridge has been rated poor structurally and warrants replacement. The replacement structure will be an integral abutment structure, consisting of an exposed reinforced concrete deck composite with rolled steel stringers. The proposed abutments will be located behind the existing granite abutments, and upper portions of the existing granite abutments will be removed.

2.0 DESIGN DISCHARGES

Design flows at the project site were evaluated under a variety of hydrologic conditions. The frequency interval of these flows ranged from the 2-year to the 500-year flood events. Multiple methodologies were conducted to estimate the design flows. Methods included two different sets of regression equations and the statistical analysis of USGS peak streamflow data in two nearby rivers. These design flows are included below in Table 1. The design flows used in the hydraulic mode were calculated with the USGS peak streamflow data method for Old Swamp River gage.

The FEMA flows were published in FEMA's Flood Insurance Study Volume 1 of 8 for Middlesex County, Massachusetts. The flow upstream of FEMA Cross Section F at Mill Street was selected. At Mill Street, the drainage area to Mill Brook #3 is 5.05 sq. miles.

One set of regression equations was developed by the USGS to estimate discharge in unregulated rivers and streams in the State of Massachusetts. These flows were estimated for the project site using the web-based USGS tool, StreamStats. The StreamStats equations are a function of drainage area, average watershed slope, and the amount of underlying stratified drift aquifer per stream length. A second set of regression equations was developed for the New England Transportation Consortium (NETC) to estimate discharge in unregulated steep-gradient streams throughout New England. The NETC equations are a function of drainage area and annual total precipitation. Both sets of regression equations, StreamStats and NETC were developed for unregulated waterways, while the StreamStats equations are most applicable to rural settings and the NETC method is most applicable to relatively steep streams. the Mill River watershed is relatively shallow sloped, located in an urbanized area, and regulated by numerous culverts and other stormwater infrastructure.

Statistically-based design flow estimates were developed using historical peak streamflow data recorded by USGS gages in two nearby rivers. One gage, #01100568, is located on the Shawsheen

River near Bedford and has 21 years of data. The drainage area contributing to the Shawsheen River at that gage is approximately 2.13 sq. miles. The second gage, #01105600, is located on Old Swamp River near South Weymouth and has 50 years of data. The drainage area contributing to the Old Swamp River at that gage is approximately 4.50 sq. miles. Both data sets were analyzed with the USGS-standard Log Pearson Type III Bulletin 17B (LP3) statistical method. While neither watershed monitored by the USGS gages is as urbanized as that of the project site's watershed, their drainage areas are relatively similar to that of the project site (5.05 sq. miles) and neither are significantly regulated by dams or culverts.

Both sets of regression equations will tend to underestimate design flows for the urban, shallow, regulated Mill River. In this case, NETC did not underestimate, but it was by chance more than design. The LP3 Old Swamp method comes up with very similar data, but is significantly more appropriate/defensible. Given the appropriateness of the LP3 method, the similar watershed size (4.50 vs. 5.05 sq. miles), and the 50-years of historical data, the design flows developed from the Old Swamp River USGS gage data were determined to be the most applicable to the project site. Mystic Street is classified as Rural Principal Arterial Street and therefore by guidelines in Mass DOT LRFD Bridge Manual, the design discharge is the 50-year frequency flood event. Hydrologic computations are included in Appendix B.

Table 1 – Design Flows

Return Frequency (Years)	FEMA (cfs)	StreamStats (cfs)	NETC (cfs)	LP3 USGS Shawsheen (cfs)	LP3 USGS Old Swamp (cfs)
2	-	149	204	770	201
5	-	244	325	1167	338
10	150	318	436	1453	449
25	-	426	586	1839	612
50	310	516	704	2142	750
100	450	610	832	2459	904
200	-	713	1001	2791	1075
500	730	861	1241	3163	1207

FEMA flows were used for the FEMA and floodway runs in the hydraulic model. The design discharges are approximately 2.4 times greater than the FEMA flows. It should be noted that, design discharges are overly conservative compared to FEMA flows and as such FEMA flows were used for the hydraulic and scour analysis.

Figure 1 – Location Map

3.0 EXISTING CONDITIONS

The Mystic Street Bridge is over 150-years old, and the bridge has severe deficiencies, which require repairs. The state of the bridge is described in Massachusetts Department of Transportation Structures Field Report from January 21, 2015. The original structure was built around 1850 with granite slabs and masonry walls for the pier and abutments. In 1958, the structure was widened with reinforced concrete slabs. Portions of the original granite slab have been strengthened with steel stringers sometime after the 1958 widening. The width of the existing structure consists of a 48-foot roadway and two 6-foot wide sidewalks. The length of the original 1850 structure is 21 feet while the lengths on the 1958 widened structure were extended out to 32.33 feet and 35.58 feet, on the west and east sides, respectively. The wearing surface of the roadway and sidewalks contains multiple cracks. The asphalt overlay on the west sidewalk has broken apart and reinforcing bars are exposed. There are hairline fractures in the superstructure. There are several stones missing from the walls of the substructure. There is moderate scour at the upstream end of the structure, and there is pile of debris located at the southwest embankment.

In the immediate vicinity of the Mystic Street Bridge, Mill Brook flows in a west to east direction. The main channel is approximately 21.5 feet wide. The main channel consists of cobbles with intermittent sand deposits. The brook has moderate to steep slopes within the project area with intermittent riffles. The northern upstream banks have a tiered slope that is composed of concrete steps. The southern

upstream side contains a steep slope with medium sized trees. The northern bank on the downstream side is bound by the wall supporting a building. Similarly, the southern bank on the upstream side is also bounded by the wall. The site has many utilities located within the roadway corridor and within the bridge crossing which include:

Below Roadway and Above Streambed:

- 1-8” gas line below at west sidewalk below concrete slab (exposed)
- 4-3.5” electric lines located within the roadway and above granite slabs
- 1-8” gas line within roadway and below granite slabs (exposed)
- 1-12” steel gas line within roadway and above granite slabs
- 8-3.5” electric lines located within the roadway and above granite slabs
- 1-8” gas line within roadway and below granite slabs (exposed)
- 1-6” steel unknown line and below granite slabs
- 2-12” electrical high-voltage black lines below east sidewalk below concrete slab
- 3-6” VCP drainage pipes through north abutment
- 1-12” RCP drainage pipe through north abutment
- 3-10” CIP drainage pipe through south abutment

Below Streambed:

- 2-10” MWRA Sanitary Sewer line at west sidewalk location
- 2-8” water lines within roadway corridor
- 2-8” cast iron Town siphon sewer lines within roadway corridor

Overhead:

- Overhead lines along west edge

4.0 PROPOSED STRUCTURE

The proposed bridge will be a single 32’-4” span integral abutment type structure, consisting of an exposed reinforced concrete deck composite with rolled steel stringers (W24x62) cast integrally with abutment diaphragms that are supported by a single row of micropiles. The proposed abutments will be located behind the existing granite abutments, and upper portions of the existing granite abutments will be removed.

The utility conflicts and site constraints pose challenges during construction. Some of the constraints include:

- There are numerous utilities within the roadway corridor as indicated in the previous section that need to be maintained, protected, and supported-in-place during construction.
- There is a utility pole in the Southwest quadrant – construction of the proposed abutment will require SOE for the pole to remain during construction.
- The MWRA sanitary sewer manhole structures limit the width of the proposed abutments.
- Groundwater was not measured during the subsurface exploration due to the rotary wash method. Therefore, the water table is assumed to be at the stream channel elevation of 9.0. Fluctuations with this elevation are expected with the seasonal flows of the stream. A bottom

of footing below this elevation will require dewatering during construction in order to maintain construction in the dry.

- The site has adjacent buildings located at the southwest and northeast quadrant of the bridge.
- Since the bridge site is located within an urban setting, other abandoned foundations and utilities, bricks or cobbles may be present within the subsurface of the site. The existing 1958 widening plans did note boulders in the upper 20 feet. Additionally, abandoned streetcar rails are known to exist below the southbound roadway surface.

5.0 HYDRAULIC MODEL

HEC-RAS, hydraulic model was used to evaluate the hydraulic conditions for the culvert replacement project. FEMA model for the study area was not available, therefore an existing conditions design model was developed by using hydraulic cross-sections based on field survey and state GIS topography using a vertical datum of NAVD88. The existing conditions design model consists of 8 cross-sections (5 upstream and 3 downstream) along a 458-foot reach of the brook which includes the Mystic Street crossing. The downstream end of the model is located 75 feet downstream of the Mystic Street Bridge to match the location of FEMA cross-section E and the upstream end is located 279 feet upstream of Mystic Street Bridge to match the location of FEMA cross-section F. A cross-section location map is included in Appendix A.

Manning's roughness coefficients were defined based on aerial photography and field observation. Contraction and expansion coefficients were estimated based on observed field conditions. Ineffective flow limits due to the roadway embankments were established based on assuming an area of non-conveyance. The boundary conditions were set to normal depth (known slope) for the upstream end while the boundary conditions for the downstream end were set to known water surface elevations based on FEMA FIS profiles. In accordance with typical modeling guidelines, the design models were run assuming mixed flow conditions and the FEMA models were run assuming sub-critical flow conditions. FEMA Floodway stations are established by approximately scaling from the effective FEMA map for the FEMA cross-sections E and F as well as for the surveyed cross-sections.

Results of the existing and proposed conditions for the design, FEMA and floodway conditions are included in Appendices D and E. Existing hydraulic conditions analysis indicates the bridge overtops during the 25-year design flows but can adequately convey the FEMA 100-year flows without overtopping. It should be noted that the design flows appear to be overly conservative. Removal of existing pier in combination with proposed widening results in increasing the hydraulic opening by approximately two times (existing 55 sq. ft. to proposed 100 sq. ft.). Proposed hydraulic conditions analysis indicates the bridge overtops during the 50-year design flows but can adequately convey the FEMA 100-year flows with improved freeboard upstream. An increase in the FEMA 100-year as well as the floodway elevations was observed at the downstream face of the bridge. This increase is a result of decrease in velocities through the proposed structure due to increased hydraulic opening. The 100-year and floodway increases at the downstream face are limited to within the roadway right-of-way and confined to the main channel. The increases do not cause adverse impacts to any adjacent properties. Efforts to eliminate such increases may result in significantly reducing the proposed hydraulic opening which in turn will increase the flooding potential at the bridge compared to the proposed conditions.

A preliminary temporary conditions hydraulic analysis was performed to evaluate the options for water handling during construction. Construction will be performed in multiple stages to remove the existing structure and install the proposed structure.

A digital copy of the hydraulic model is included in a CD.

6.0 SCOUR ASSESSMENT

Scour assessment has been performed for the proposed structure. Scour depths have been estimated following the procedures outlined in the latest April 2012 edition of HEC-18- Evaluating Scour at Bridges. As recommended in the Mass DOT LRFD Bridge Manual, the following amended local abutment scour equation was utilized:

Ys/Ya = [2.27 K1 K2 (L'/Ya)0.43 Fr0.61] + 0.05

This equation predicts scour depths for the 50th percentile as compared to the more conservative HEC-18 version of Froehlich's equation (Equation 8.1, HEC-18, 2012), which would have encompassed 98% of the laboratory produced scour holes from the original study. The HEC-18 version of Froehlich's equation is as follows:

Ys/Ya = [2.27 K1 K2 (L'/Ya)0.43 Fr0.61] + 1

In accordance with HEC-18, scour was evaluated for the following scour conditions:

- Long-term channel degradation and aggradation.
- Lateral contraction scour (HEC-18, Sections 6.1-6.4). Contraction scour is not applicable for pressure flow conditions and therefore contraction scour for 50-, 100- and 200-year events are excluded from the total scour estimate.
- Pressure flow scour also known as vertical contraction scour.
- Amended Froehlich's local abutment scour
- Total scour following procedures described in the National Cooperative Highway Research Program Report Estimation of Scour Depth at Bridge Abutments, NCHRP 24-20, 2010. It should not be used for live-bed or pressure flow conditions. Since conditions for this project are pressure flow for larger storm events, this method has not been used to estimate scour depths for the proposed bridge.

Scour Computations

Pressure flow (vertical contraction scour) during larger storm events is the primary component which causes scour at the proposed structure. Scour computations for the proposed crossing have been prepared for the 10-year discharge as well as the 25-year hydraulic design flow, 50-year scour design flow and 100-year scour check frequency. An estimate of D50 is based on a soil grab sample of existing material taken at the site. Based on observed field conditions it appears that the present streambed is generally vertically stable and, as such, future long-term channel scour has been assumed to be negligible.

Mystic Street is classified as Rural Principal Arterial Street and therefore by guidelines in Mass DOT LRFD Bridge Manual, the scour design discharge is the 100-year frequency flood with the 200-year flow being the scour check discharge. Scour computations are included in Appendix F. Table 2 summarizes the results of the scour evaluations prepared for the project:

Table 2- Computed Proposed Bridge Scour

Abutment	Estimated Total Scour Depth (feet)	Estimated Scour Elevation (feet, NAVD88)
10 Year Discharge		
Northerly	0	8.6
Southerly	0	8.6
50 Year Discharge		
Northerly	0.45	8.15
Southerly	0.83	7.77
100 Year Discharge		
Northerly	0.85	7.75
Southerly	1.56	7.04
200 Year Discharge		
Northerly	1.24	7.00
Southerly	2.04	6.20

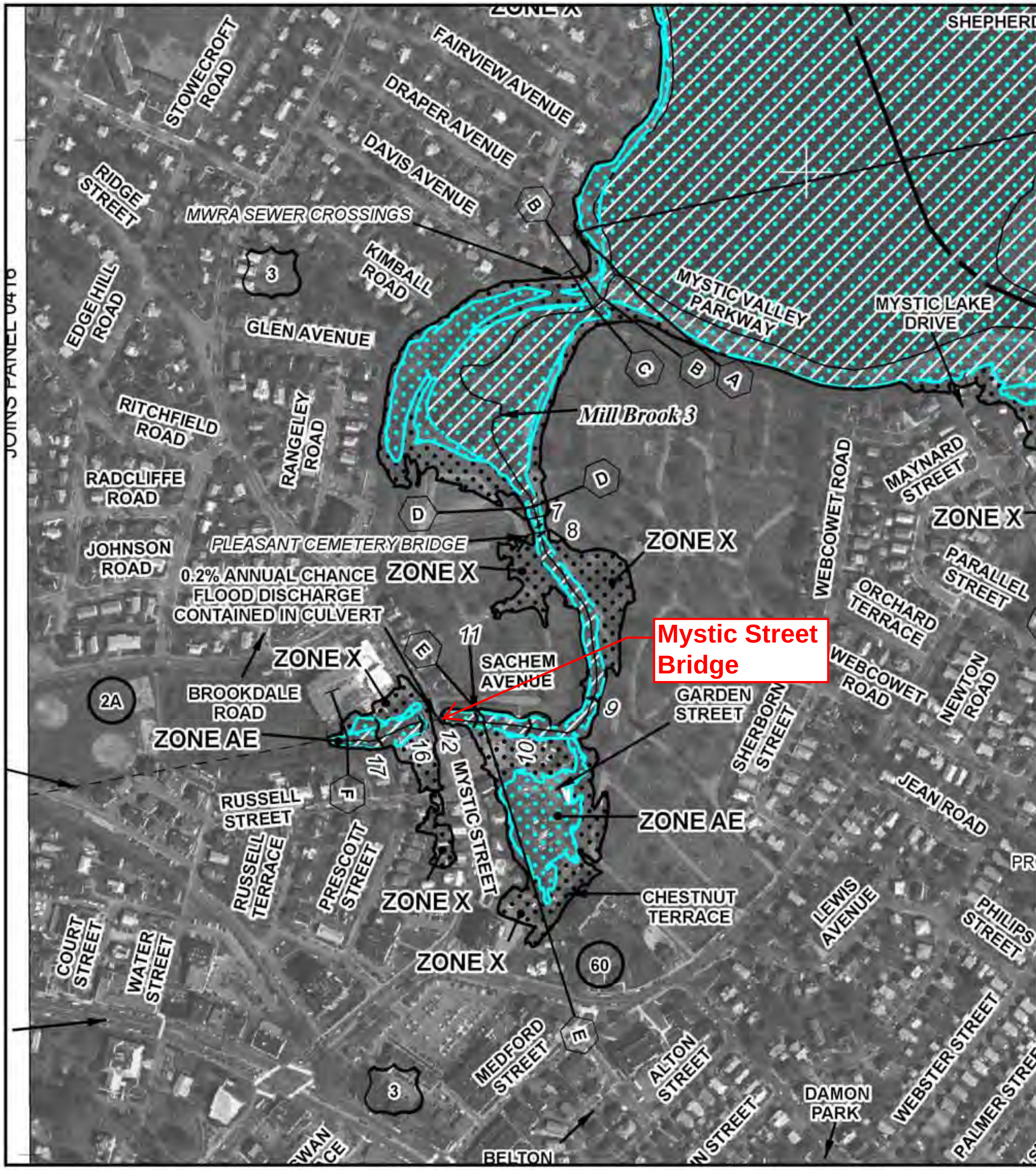
Due to utility conflicts and constructability issues, it is not possible to provide conventional spread footings below the predicted scour depth. The proposed structure will be placed on micropiles. Existing abutments will be cut off at the top to the elevation shown on the plans. Riprap will be placed along the four corners of the bridge to prevent future erosion at the immediate banks and behind the existing abutments.

7.0 CONCLUSION

The proposed work detailed in this report has been designed in accordance with hydraulic standards and criteria prescribed in Massachusetts LRFD Bridge Design Manual. The proposed bridge design and construction faces tremendous challenges with possible conflicts from several utilities at the site. The proposed structure will be a scour resistant structure with significant improvements to the hydraulic conveying capacity.

APPENDIX A

Figures



PANEL 0417E

FIRM

FLOOD INSURANCE RATE MAP

NATIONAL FLOOD INSURANCE PROGRAM

NFIP

MIDDLESEX COUNTY, MASSACHUSETTS
(ALL JURISDICTIONS)

PANEL 417 OF 656

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ARLINGTON, TOWN OF	250177	0417	E
MEDFORD, CITY OF	250205	0417	E
SOMERVILLE, CITY OF	250214	0417	E
WINCHESTER, TOWN OF	250228	0417	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

U.S. DEPARTMENT OF HOMELAND SECURITY

MAP NUMBER
25017C0417E

EFFECTIVE DATE
JUNE 4, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

THE REPLACEMENT OF
MYSTIC BRIDGE OVER
MILL BROOK #3

FIGURE 2
CROSS SECTION LOCATION PLAN

SCALE: 1"=50'

0 50' 100' 150'

DATE: JULY 2017

APPENDIX B

Hydrology Computations

StreamStats Version 3.0

Flow Statistics Ungaged Site Report

Date: Wed July 19, 2017 7:19:02 AM GMT-4
Study Area: Massachusetts
NAD 1983 Latitude: 42.4186 (42 25 07)
NAD 1983 Longitude: -71.1512 (-71 09 05)
Drainage Area: 5.05 mi2

Low Flows Basin Characteristics			
100% Statewide Low Flow WRIR00 4135 (5.05 mi2)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	5.05	1.61	149
Mean Basin Slope from 250K DEM (percent)	3.242	0.32	24.6
Stratified Drift per Stream Length (square mile per mile)	0.17	0	1.29
Massachusetts Region (dimensionless)	0	0	1

Probability of Perennial Flow Basin Characteristics			
100% Perennial Flow Probability (5.05 mi2)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	5.05 (above max value 1.99)	0.01	1.99
Percent Underlain By Sand And Gravel (percent)	41.03	0	100
Percent Forest (percent)	11.92	0	100
Massachusetts Region (dimensionless)	0	0	1

Warning: Some parameters are outside the suggested range. Estimates will be extrapolations with unknown errors.

Bankfull Flows Basin Characteristics			
100% Bankfull Statewide SIR2013 5155 (5.05 mi2)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	5.05	0.6	329
Mean Basin Slope from 10m DEM (percent)	7.031	2.2	23.9

Peak Flow Regions Basin Characteristics			
100% Peak Statewide 2016 5156 (5.05 mi2)			
Parameter	Value	Regression Equation Valid Range	
		Min	Max
Drainage Area (square miles)	5.05	0.16	512
Mean Basin Elevation (feet)	200	80.6	1948
Percent Storage from NLCD2006 (percent)	5.12	0	32.3

Low Flows Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
D50	4.98	ft3/s	18		2.47	9.98
D60	3.56	ft3/s	20		1.77	7.11

D70	2.15	ft3/s	24		1.05	4.35
D75	1.66	ft3/s	26		0.81	3.37
D80	1.43	ft3/s	28		0.66	3.04
D85	1.07	ft3/s	32		0.47	2.37
D90	0.83	ft3/s	37		0.35	1.92
D95	0.49	ft3/s	46		0.18	1.27
D98	0.3	ft3/s	60		0.097	0.91
D99	0.22	ft3/s	65		0.067	0.71
M7D2Y	0.48	ft3/s	50		0.17	1.29
AUGD50	1.11	ft3/s	33		0.48	2.51
M7D10Y	0.21	ft3/s	71		0.0584	0.69

http://pubs.usgs.gov/wri/wri004135/ (http://pubs.usgs.gov/wri/wri004135/)
Ries_ K.G._ III_ 2000_ Methods for estimating low-flow statistics for Massachusetts streams: U.S. Geological Survey Water Resources Investigations Report 00-4135_ 81 p.

Probability of Perennial Flow Statistics						
Statistic	Value	Unit	Standard Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
PROBPEREN	0.99	dim				

http://pubs.usgs.gov/sir/2006/5031/pdfs/SIR_2006-5031rev.pdf (http://pubs.usgs.gov/sir/2006/5031/pdfs/SIR_2006-5031rev.pdf)
Bent_ G.C._ and Steeves_ P.A._ 2006_ A revised logistic regression equation and an automated procedure for mapping the probability of a stream flowing perennially in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2006–5031_ 107 p.

Bankfull Flows Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
BFWDTH	28.4	ft	21			
BFDPTH	1.51	ft	20			
BFAREA	42.6	ft2	29			
BFFLOW	125	ft3/s	55			

http://pubs.usgs.gov/sir/2013/5155/ (http://pubs.usgs.gov/sir/2013/5155/)
Bent_ G.C._ and Waite_ A.M._ 2013_ Equations for estimating bankfull channel geometry and discharge for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2013–5155_ 62 p._

Peak Flow Regions Statistics						
Statistic	Value	Unit	Prediction Error (percent)	Equivalent years of record	90-Percent Prediction Interval	
					Min	Max
PK2	149	ft3/s	42			
PK5	244	ft3/s	43			
PK10	318	ft3/s	45			
PK25	426	ft3/s	47			
PK50	516	ft3/s	49			
PK100	610	ft3/s	52			
PK200	713	ft3/s	54			
PK500	861	ft3/s	58			

https://dx.doi.org/10.3133/sir20165156 (https://dx.doi.org/10.3133/sir20165156)
Zarriello_ P.J._ 2017_ Magnitude of flood flows at selected annual exceedance probabilities for streams in Massachusetts: U.S. Geological Survey Scientific Investigations Report 2016–5156_ 99 p.

NETC Method

Project Site

Recurrence Interval (years)	Coefficient	Area (mi2)	Area C	Annual Precip. (inches)	Precip. C	Design Flow (cfs)
2	0.01601	5.05	0.889	43.76	2.12	204
5	0.01965	5.05	0.889	43.76	2.19	325
10	0.02430	5.05	0.891	43.76	2.21	436
25	0.03387	5.05	0.893	43.76	2.20	586
50	0.04372	5.05	0.895	43.76	2.18	704
100	0.05765	5.05	0.897	43.76	2.15	832
200						*1,001*
500	0.11100	5.05	0.903	43.76	2.08	1,241

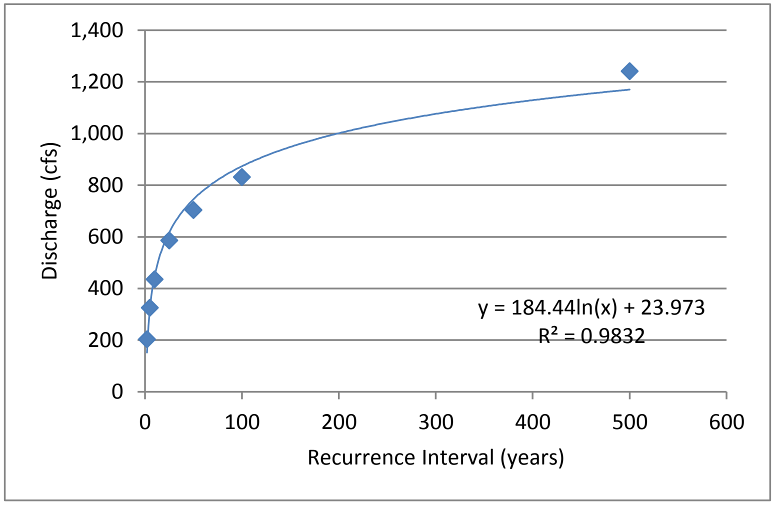


Table 2. Regression equations and their accuracy for estimating peak flows for steep, ungaged, unregulated drainage basins in New England. Steep is defined as a main channel slope that exceeds 50 ft per mile. [Q is peak flow, in cubic feet per second; A is drainage area, in square miles; P is mean annual precipitation in inches]

Peak-flow regression equation by recurrence interval	Standard Error of the Estimate (percent)		$(PRESS/n)^{1/2}$ (percent)		Average Prediction Error (percent)		Average Equivalent Yrs of Record
$Q_2=0.01601A^{0.889}P^{2.12}$	47.1%	-32.0%	46.9%	-31.9%	48.1%	-32.5%	2.09
$Q_5=0.01965A^{0.889}P^{2.19}$	45.1%	-31.1%	44.8%	-30.9%	46.1%	-31.6%	3.03
$Q_{10}=0.02430A^{0.891}P^{2.21}$	46.5%	-31.7%	46.4%	-31.7%	47.5%	-32.2%	3.89
$Q_{25}=0.03387A^{0.893}P^{2.20}$	50.4%	-33.5%	50.7%	-33.7%	51.5%	-34.0%	4.73
$Q_{50}=0.04372A^{0.895}P^{2.18}$	54.5%	-35.3%	55.2%	-30.9%	55.8%	-35.8%	5.10
$Q_{100}=0.05765A^{0.897}P^{2.15}$	59.4%	-37.3%	60.5%	-37.7%	60.8%	-37.8%	5.29
$Q_{500}=0.111A^{0.903}P^{2.08}$	73.4%	-42.3%	75.3%	-43.0%	75.1%	-42.9%	

Flood Frequency Analysis Calculator: Log-Pearson Type III Distribution ***NOTE: Only enter data/edit yel***

USGS Gaging Station Name: Shawsheen River, Bedford **USGS Site ID:** 01100568

Step 1: On separate sheet, sort PeakQ with date, from highest to lowest; Step 2: Paste sorted dates and Qpeak into Col B ar

RANK	YEAR OF PEAK FLOW	PEAK_FLOW_ VALUE_Q(cfs)	LOGQ_cfs	(log Q – avg(logQ))^2	(log Q – avg(logQ))^3	Return Period (n+1)/m	Exceedence Probability (1/Tr)
1	2011	1648	3.217	0.1082	0.0356	22.00	0.045
2	1998	1622	3.210	0.1037	0.0334	11.00	0.091
3	1999	1453	3.162	0.0752	0.0206	7.33	0.136
4	2003	1266	3.102	0.0460	0.0099	5.50	0.182
5	2014	1138	3.056	0.0283	0.0048	4.40	0.227
6	2010	1017	3.007	0.0142	0.0017	3.67	0.273
7	1997	884	2.946	0.0034	0.0002	3.14	0.318
8	2005	882	2.945	0.0033	0.0002	2.75	0.364
9	1996	865	2.937	0.0024	0.0001	2.44	0.409
10	2001	839	2.924	0.0013	0.0000	2.20	0.455
11	2015	**782**	2.893	0.0000	0.0000	2.00	0.500
12	**2013**	773	2.888	0.0000	0.0000	1.83	0.545
13	2012	747	2.873	0.0002	0.0000	1.69	0.591
14	2002	723	2.859	0.0008	0.0000	1.57	0.636
15	2008	645	2.810	0.0062	-0.0005	1.47	0.682
16	2009	616	2.790	0.0097	-0.0010	1.38	0.727
17	2007	588	2.769	0.0141	-0.0017	1.29	0.773
18	2006	557	2.746	0.0202	-0.0029	1.22	0.818
19	2004	427	2.630	0.0664	-0.0171	1.16	0.864
20	2000	315	2.498	0.1519	-0.0592	1.10	0.909
21	2016	242	2.384	0.2542	-0.1282	1.05	0.955

low cells; do not alter white or blue cells

nd C, respectively

No. Years in Record	21.00	
Avg_Qpeak_cfs	858.52	
Avg_LogQ_cfs	2.888	
Sum {(log Q – avg(logQ))^2}	0.910	
Sum {(log Q – avg(logQ))^3	-0.104	
Variance_LogQ_cfs	0.0455	
Stdev_LogQ_cfs	0.2133	
Skewness (Cs)	-0.5927	
Skew Coefficient (Cm)	0.70	**Determine from skew coefficient Map of US
Variance of Regional Skewness V(Cm)	0.302	**Constant for U.S. = 0.302
Variance of Station Skewness (V(Cs):	0.29119	**$V(Cs)=10^{[A-B*(log(n/10))]}$
A value	-0.28259	
B value	0.78591	
Weighting Factor (W)	0.50911	**W=V(Cm)/[V(Cs)+V(Cm)]
Weighted Skewness (Cw)	0.0419	**Cw = [W*Cs] + [(1-W)*Cm]
Table Cw upper	0.1	**Paste value here from K factor table below
Table Cw lower	0	**Paste value here from K factor table below
Calculated Cw Value	0.0419	

Tr	K lower	K upper	Slope	K calculated	$LogQ_{Tr}$_cfs	Q_{Tr}_cfs
2	0.000	-0.017	-0.17	-0.007	2.887	770.04
5	0.842	0.836	-0.06	0.839	3.067	1167
10	1.282	1.292	0.1	1.286	3.162	1453.2
25	1.751	1.785	0.34	1.765	3.264	1838.6
50	2.054	2.107	0.53	2.076	3.331	2142
100	2.326	2.400	0.74	2.357	3.391	2458.6
200	2.576	2.670	0.94	2.615	3.446	2791.3

*Note: paste K lower and upper values from K factor table below

Frequency Factors K for Gamma and log-Pearson Type III Distributions (Haan, 1977, Table 7.7)

	Recurrence Interval In Years							
WEIGHTED	1.0101	2	5	10	25	50	100	200
SKEW COEFFICIENT	Percent Chance (>=) = 1-F							
Cw	99	50	20	10	4	2	1	0.5
3	-0.667	-0.396	0.42	1.18	2.278	3.152	4.051	4.97
2.9	-0.69	-0.39	0.44	1.195	2.277	3.134	4.013	4.904
2.8	-0.714	-0.384	0.46	1.21	2.275	3.114	3.973	4.847
2.7	-0.74	-0.376	0.479	1.224	2.272	3.093	3.932	4.783
2.6	-0.769	-0.368	0.499	1.238	2.267	3.071	3.889	4.718
2.5	-0.799	-0.36	0.518	1.25	2.262	3.048	3.845	4.652
2.4	-0.832	-0.351	0.537	1.262	2.256	3.023	3.8	4.584
2.3	-0.867	-0.341	0.555	1.274	2.248	2.997	3.753	4.515
2.2	-0.905	-0.33	0.574	1.284	2.24	2.97	3.705	4.444
2.1	-0.946	-0.319	0.592	1.294	2.23	2.942	3.656	4.372
2	-0.99	-0.307	0.609	1.302	2.219	2.912	3.605	4.298
1.9	-1.037	-0.294	0.627	1.31	2.207	2.881	3.553	4.223
1.8	-1.087	-0.282	0.643	1.318	2.193	2.848	3.499	4.147
1.7	-1.14	-0.268	0.66	1.324	2.179	2.815	3.444	4.069
1.6	-1.197	-0.254	0.675	1.329	2.163	2.78	3.388	3.99
1.5	-1.256	-0.24	0.69	1.333	2.146	2.743	3.33	3.91
1.4	-1.318	-0.225	0.705	1.337	2.128	2.706	3.271	3.828
1.3	-1.383	-0.21	0.719	1.339	2.108	2.666	3.211	3.745
1.2	-1.449	-0.195	0.732	1.34	2.087	2.626	3.149	3.661
1.1	-1.518	-0.18	0.745	1.341	2.066	2.585	3.087	3.575
1	-1.588	-0.164	0.758	1.34	2.043	2.542	3.022	3.489
0.9	-1.66	-0.148	0.769	1.339	2.018	2.498	2.957	3.401
0.8	-1.733	-0.132	0.78	1.336	1.993	2.453	2.891	3.312
0.7	-1.806	-0.116	0.79	1.333	1.967	2.407	2.824	3.223
0.6	-1.88	-0.099	0.8	1.328	1.939	2.359	2.755	3.132
0.5	-1.955	-0.083	0.808	1.323	1.91	2.311	2.686	3.041
0.4	-2.029	-0.066	0.816	1.317	1.88	2.261	2.615	2.949
0.3	-2.104	-0.05	0.824	1.309	1.849	2.211	2.544	2.856
0.2	-2.178	-0.033	0.83	1.301	1.818	2.159	2.472	2.763
0.1	-2.252	-0.017	0.836	1.292	1.785	2.107	2.4	2.67
0	-2.326	0	0.842	1.282	1.751	2.054	2.326	2.576
-0.1	-2.4	0.017	0.846	1.27	1.716	2	2.252	2.482
-0.2	-2.472	0.033	0.85	1.258	1.68	1.945	2.178	2.388
-0.3	-2.544	0.05	0.853	1.245	1.643	1.89	2.104	2.294
-0.4	-2.615	0.066	0.855	1.231	1.606	1.834	2.029	2.201
-0.5	-2.686	0.083	0.856	1.216	1.567	1.777	1.955	2.108
-0.6	-2.755	0.099	0.857	1.2	1.528	1.72	1.88	2.016
-0.7	-2.824	0.116	0.857	1.183	1.488	1.663	1.806	1.926
-0.8	-2.891	0.132	0.856	1.166	1.448	1.606	1.733	1.837
-0.9	-2.957	0.148	0.854	1.147	1.407	1.549	1.66	1.749
-1	-3.022	0.164	0.852	1.128	1.366	1.492	1.588	1.664
-1.1	-3.087	0.18	0.848	1.107	1.324	1.435	1.518	1.581
-1.2	-3.149	0.195	0.844	1.086	1.282	1.379	1.449	1.501
-1.3	-3.211	0.21	0.838	1.064	1.24	1.324	1.383	1.424
-1.4	-3.271	0.225	0.832	1.041	1.198	1.27	1.318	1.351
-1.5	-3.33	0.24	0.825	1.018	1.157	1.217	1.256	1.282
-1.6	-3.88	0.254	0.817	0.994	1.116	1.166	1.197	1.216
-1.7	-3.444	0.268	0.808	0.97	1.075	1.116	1.14	1.155
-1.8	-3.499	0.282	0.799	0.945	1.035	1.069	1.087	1.097
-1.9	-3.553	0.294	0.788	0.92	0.996	1.023	1.037	1.044
-2	-3.605	0.307	0.777	0.895	0.959	0.98	0.99	0.995
-2.1	-3.656	0.319	0.765	0.869	0.923	0.939	0.946	0.949
-2.2	-3.705	0.33	0.752	0.844	0.888	0.9	0.905	0.907
-2.3	-3.753	0.341	0.739	0.819	0.855	0.864	0.867	0.869
-2.4	-3.8	0.351	0.725	0.795	0.823	0.83	0.832	0.833
-2.5	-3.845	0.36	0.711	0.711	0.793	0.798	0.799	0.8
-2.6	-3.899	0.368	0.696	0.747	0.764	0.768	0.769	0.769
-2.7	-3.932	0.376	0.681	0.724	0.738	0.74	0.74	0.741
-2.8	-3.973	0.384	0.666	0.702	0.712	0.714	0.714	0.714
-2.9	-4.013	0.39	0.651	0.681	0.683	0.689	0.69	0.69
-3	-4.051	0.396	0.636	0.66	0.666	0.666	0.667	0.667

Flood Frequency Analysis Calculator: Log-Pearson Type III Distribution ***NOTE: Only enter data/edit yel***

USGS Gaging Station Name: Old Swamp, S. Weymouth **USGS Site ID:** 01105600

Step 1: On separate sheet, sort PeakQ with date, from highest to lowest; Step 2: Paste sorted dates and Qpeak into Col B an

RANK	YEAR OF PEAK FLOW	PEAK_FLOW_ VALUE_Q(cfs)	LOGQ_cfs	(log Q – avg(logQ))^2	(log Q – avg(logQ))^3	Return Period (n+1)/m	Exceedence Probability (1/Tr)
1	1984	662	2.821	0.2592	0.1319	51.00	0.020
2	1968	635	2.803	0.2411	0.1184	25.50	0.039
3	1970	527	2.722	0.1681	0.0689	17.00	0.059
4	1982	525	2.720	0.1668	0.0681	12.75	0.078
5	2006	514	2.711	0.1593	0.0636	10.20	0.098
6	2005	451	2.654	0.1172	0.0401	8.50	0.118
7	2010	448	2.651	0.1153	0.0391	7.29	0.137
8	1978	402	2.604	0.0855	0.0250	6.38	0.157
9	1994	376	2.575	0.0694	0.0183	5.67	0.176
10	1983	362	2.559	0.0610	0.0151	5.10	0.196
11	1969	**342**	2.534	0.0494	0.0110	4.64	0.216
12	**1996**	341	2.533	0.0488	0.0108	4.25	0.235
13	1997	340	2.531	0.0483	0.0106	3.92	0.255
14	1974	337	2.528	0.0466	0.0101	3.64	0.275
15	2001	325	2.512	0.0400	0.0080	3.40	0.294
16	1993	321	2.507	0.0379	0.0074	3.19	0.314
17	1976	257	2.410	0.0096	0.0009	3.00	0.333
18	2008	254	2.405	0.0087	0.0008	2.83	0.353
19	1998	251	2.400	0.0077	0.0007	2.68	0.373
20	1967	232	2.365	0.0029	0.0002	2.55	0.392
21	2009	221	2.344	0.0011	0.0000	2.43	0.412
22	2007	217	2.336	0.0006	0.0000	2.32	0.431
23	1995	200	2.301	0.0001	0.0000	2.22	0.451
24	1979	196	2.292	0.0004	0.0000	2.13	0.471
25	1999	192	2.283	0.0008	0.0000	2.04	0.490
26	2004	192	2.283	0.0008	0.0000	1.96	0.510
27	2012	184	2.265	0.0022	-0.0001	1.89	0.529
28	1992	176	2.246	0.0044	-0.0003	1.82	0.549
29	2015	172	2.236	0.0058	-0.0004	1.76	0.569
30	1987	168	2.225	0.0075	-0.0006	1.70	0.588
31	2013	164	2.215	0.0094	-0.0009	1.65	0.608
32	1981	162	2.210	0.0105	-0.0011	1.59	0.627
33	1972	154	2.188	0.0154	-0.0019	1.55	0.647
34	2000	149	2.173	0.0192	-0.0027	1.50	0.667
35	1977	146	2.164	0.0217	-0.0032	1.46	0.686
36	1991	143	2.155	0.0245	-0.0038	1.42	0.706
37	2003	143	2.155	0.0245	-0.0038	1.38	0.725
38	1988	132	2.121	0.0366	-0.0070	1.34	0.745
39	1990	130	2.114	0.0391	-0.0077	1.31	0.765
40	1973	125	2.097	0.0462	-0.0099	1.28	0.784
41	2014	119	2.076	0.0558	-0.0132	1.24	0.804
42	1971	116	2.064	0.0612	-0.0151	1.21	0.824
43	2016	105	2.021	0.0844	-0.0245	1.19	0.843
44	1980	104	2.017	0.0869	-0.0256	1.16	0.863
45	1986	100	2.000	0.0972	-0.0303	1.13	0.882
46	2011	95	1.978	0.1116	-0.0373	1.11	0.902
47	2002	93	1.968	0.1179	-0.0405	1.09	0.922
48	1975	91	1.959	0.1244	-0.0439	1.06	0.941
49	1989	84	1.924	0.1502	-0.0582	1.04	0.961
50	1985	43	1.633	0.4601	-0.3121	1.02	0.980

low cells; do not alter white or blue cells

nd C, respectively

No. Years in Record	50.00	
Avg_Qpeak_cfs	244.36	
Avg_LogQ_cfs	2.312	
Sum {(log Q – avg(logQ))^2}	3.363	
Sum {(log Q – avg(logQ))^3	0.005	
Variance_LogQ_cfs	0.0686	
Stdev_LogQ_cfs	0.2620	
Skewness (Cs)	0.0056	
Skew Coefficient (Cm)	0.70	**Determine from skew coefficient Map of US
Variance of Regional Skewness V(Cm)	0.302	**Constant for U.S. = 0.302
Variance of Station Skewness (V(Cs):	0.10338	**V(Cs)=10^[A-B*(log(n/10))]
A value	-0.32955	
B value	0.93854	
Weighting Factor (W)	0.74498	**W=V(Cm)/[V(Cs)+V(Cm)]
Weighted Skewness (Cw)	0.1827	**Cw = [W*Cs] + [(1-W)*Cm]
Table Cw upper	0.2	**Paste value here from K factor table below
Table Cw lower	0.1	**Paste value here from K factor table below
Calculated Cw Value	0.1827	

Tr	K lower	K upper	Slope	K calculated	$LogQ_{Tr}$_cfs	Q_{Tr}_cfs
2	-0.017	-0.033	-0.16	-0.030	2.304	201.31
5	0.836	0.830	-0.06	0.831	2.529	338.45
10	1.292	1.301	0.09	1.299	2.652	448.97
25	1.785	1.818	0.33	1.812	2.787	611.75
50	2.107	2.159	0.52	2.150	2.875	749.98
100	2.400	2.472	0.72	2.460	2.956	903.94
200	2.670	2.763	0.93	2.747	3.031	1075

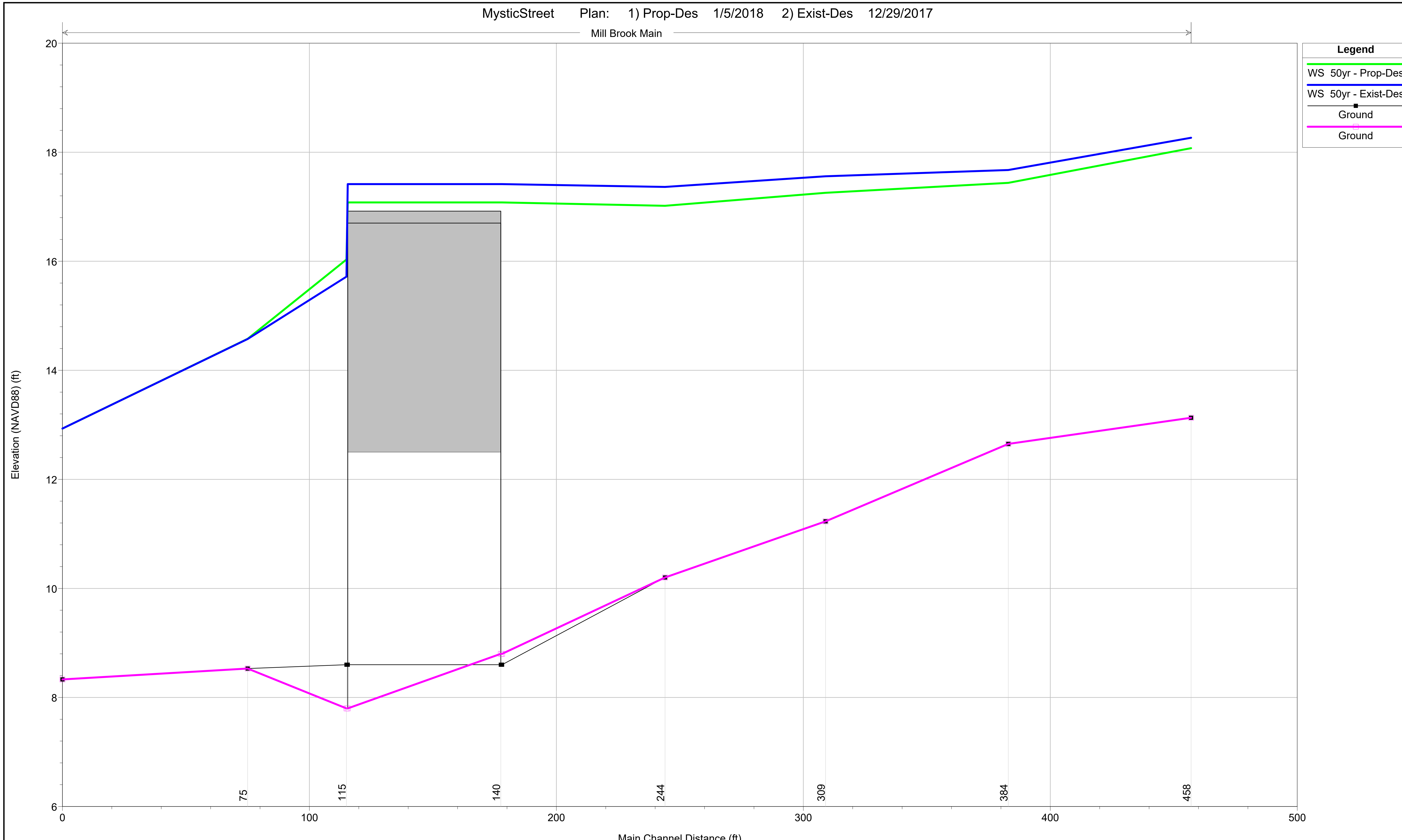
*Note: paste K lower and upper values from K factor table below

Frequency Factors K for Gamma and log-Pearson Type III Distributions (Haan, 1977, Table 7.7)

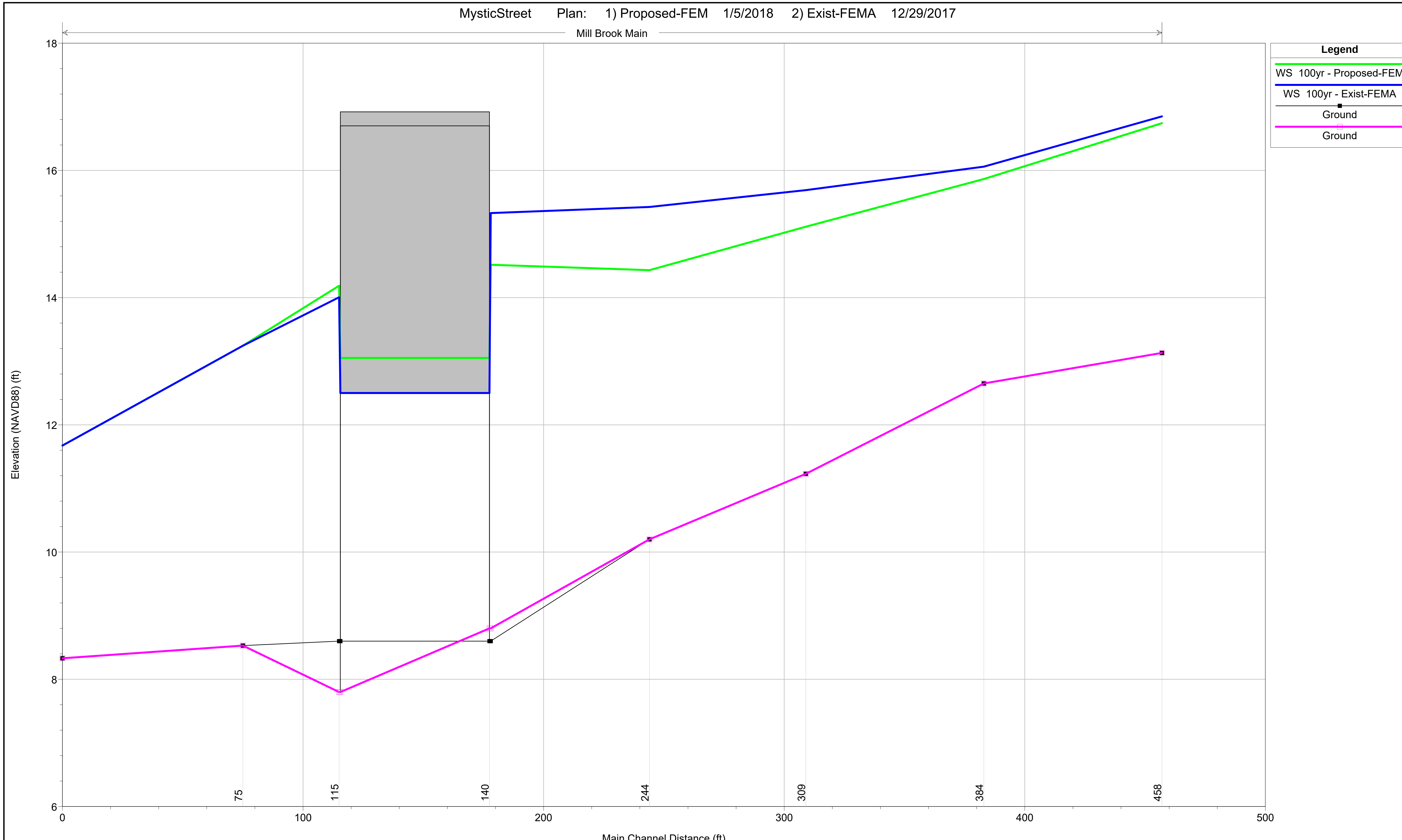
	Recurrence Interval In Years							
WEIGHTED	**1.0101**	**2**	**5**	**10**	**25**	**50**	**100**	**200**
SKEW COEFFICIENT	**Percent Chance (>=) = 1-F**							
Cw	**99**	**50**	**20**	**10**	**4**	**2**	**1**	**0.5**
3	-0.667	-0.396	0.42	1.18	2.278	3.152	4.051	4.97
2.9	-0.69	-0.39	0.44	1.195	2.277	3.134	4.013	4.904
2.8	-0.714	-0.384	0.46	1.21	2.275	3.114	3.973	4.847
2.7	-0.74	-0.376	0.479	1.224	2.272	3.093	3.932	4.783
2.6	-0.769	-0.368	0.499	1.238	2.267	3.071	3.889	4.718
2.5	-0.799	-0.36	0.518	1.25	2.262	3.048	3.845	4.652
2.4	-0.832	-0.351	0.537	1.262	2.256	3.023	3.8	4.584
2.3	-0.867	-0.341	0.555	1.274	2.248	2.997	3.753	4.515
2.2	-0.905	-0.33	0.574	1.284	2.24	2.97	3.705	4.444
2.1	-0.946	-0.319	0.592	1.294	2.23	2.942	3.656	4.372
2	-0.99	-0.307	0.609	1.302	2.219	2.912	3.605	4.298
1.9	-1.037	-0.294	0.627	1.31	2.207	2.881	3.553	4.223
1.8	-1.087	-0.282	0.643	1.318	2.193	2.848	3.499	4.147
1.7	-1.14	-0.268	0.66	1.324	2.179	2.815	3.444	4.069
1.6	-1.197	-0.254	0.675	1.329	2.163	2.78	3.388	3.99
1.5	-1.256	-0.24	0.69	1.333	2.146	2.743	3.33	3.91
1.4	-1.318	-0.225	0.705	1.337	2.128	2.706	3.271	3.828
1.3	-1.383	-0.21	0.719	1.339	2.108	2.666	3.211	3.745
1.2	-1.449	-0.195	0.732	1.34	2.087	2.626	3.149	3.661
1.1	-1.518	-0.18	0.745	1.341	2.066	2.585	3.087	3.575
1	-1.588	-0.164	0.758	1.34	2.043	2.542	3.022	3.489
0.9	-1.66	-0.148	0.769	1.339	2.018	2.498	2.957	3.401
0.8	-1.733	-0.132	0.78	1.336	1.993	2.453	2.891	3.312
0.7	-1.806	-0.116	0.79	1.333	1.967	2.407	2.824	3.223
0.6	-1.88	-0.099	0.8	1.328	1.939	2.359	2.755	3.132
0.5	-1.955	-0.083	0.808	1.323	1.91	2.311	2.686	3.041
0.4	-2.029	-0.066	0.816	1.317	1.88	2.261	2.615	2.949
0.3	-2.104	-0.05	0.824	1.309	1.849	2.211	2.544	2.856
0.2	-2.178	-0.033	0.83	1.301	1.818	2.159	2.472	2.763
0.1	-2.252	-0.017	0.836	1.292	1.785	2.107	2.4	2.67
0	-2.326	0	0.842	1.282	1.751	2.054	2.326	2.576
-0.1	-2.4	0.017	0.846	1.27	1.716	2	2.252	2.482
-0.2	-2.472	0.033	0.85	1.258	1.68	1.945	2.178	2.388
-0.3	-2.544	0.05	0.853	1.245	1.643	1.89	2.104	2.294
-0.4	-2.615	0.066	0.855	1.231	1.606	1.834	2.029	2.201
-0.5	-2.686	0.083	0.856	1.216	1.567	1.777	1.955	2.108
-0.6	-2.755	0.099	0.857	1.2	1.528	1.72	1.88	2.016
-0.7	-2.824	0.116	0.857	1.183	1.488	1.663	1.806	1.926
-0.8	-2.891	0.132	0.856	1.166	1.448	1.606	1.733	1.837
-0.9	-2.957	0.148	0.854	1.147	1.407	1.549	1.66	1.749
-1	-3.022	0.164	0.852	1.128	1.366	1.492	1.588	1.664
-1.1	-3.087	0.18	0.848	1.107	1.324	1.435	1.518	1.581
-1.2	-3.149	0.195	0.844	1.086	1.282	1.379	1.449	1.501
-1.3	-3.211	0.21	0.838	1.064	1.24	1.324	1.383	1.424
-1.4	-3.271	0.225	0.832	1.041	1.198	1.27	1.318	1.351
-1.5	-3.33	0.24	0.825	1.018	1.157	1.217	1.256	1.282
-1.6	-3.88	0.254	0.817	0.994	1.116	1.166	1.197	1.216
-1.7	-3.444	0.268	0.808	0.97	1.075	1.116	1.14	1.155
-1.8	-3.499	0.282	0.799	0.945	1.035	1.069	1.087	1.097
-1.9	-3.553	0.294	0.788	0.92	0.996	1.023	1.037	1.044
-2	-3.605	0.307	0.777	0.895	0.959	0.98	0.99	0.995
-2.1	-3.656	0.319	0.765	0.869	0.923	0.939	0.946	0.949
-2.2	-3.705	0.33	0.752	0.844	0.888	0.9	0.905	0.907
-2.3	-3.753	0.341	0.739	0.819	0.855	0.864	0.867	0.869
-2.4	-3.8	0.351	0.725	0.795	0.823	0.83	0.832	0.833
-2.5	-3.845	0.36	0.711	0.711	0.793	0.798	0.799	0.8
-2.6	-3.899	0.368	0.696	0.747	0.764	0.768	0.769	0.769
-2.7	-3.932	0.376	0.681	0.724	0.738	0.74	0.74	0.741
-2.8	-3.973	0.384	0.666	0.702	0.712	0.714	0.714	0.714
-2.9	-4.013	0.39	0.651	0.681	0.683	0.689	0.69	0.69
-3	-4.051	0.396	0.636	0.66	0.666	0.666	0.667	0.667

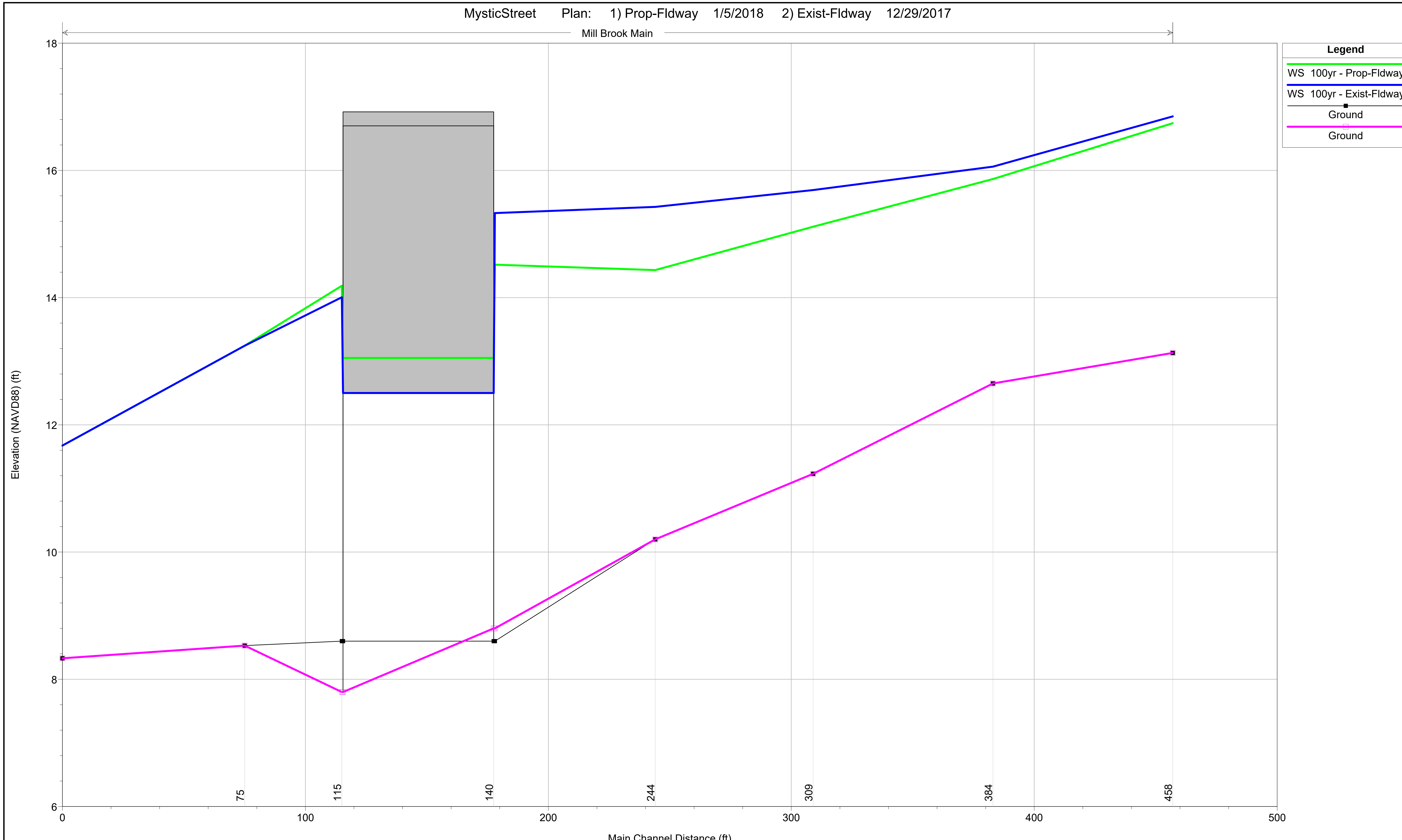
APPENDIX C

HEC-RAS Profiles



MysticStreet Plan: 1) Prop-Des 1/5/2018 2) Exist-Des 12/29/2017
Mill Brook Main
Legend
WS 50yr - Prop-Des
WS 50yr - Exist-Des
Ground
Ground
Elevation (NAVD88) (ft)
Main Channel Distance (ft)
20
18
16
14
12
10
8
6
0
100
200
300
400
500
75
115
140
244
309
384
458


MysticStreet Plan: 1) Proposed-FEM 1/5/2018 2) Exist-FEMA 12/29/2017
Mill Brook Main
Legend
WS 100yr - Proposed-FEM
WS 100yr - Exist-FEMA
Ground
Ground
Elevation (NAVD88) (ft)
18
16
14
12
10
8
6
75
115
140
244
309
384
458
0
100
200
300
400
500
Main Channel Distance (ft)


MysticStreet Plan: 1) Prop-Fldway 1/5/2018 2) Exist-Fldway 12/29/2017
Mill Brook Main
Legend
WS 100yr - Prop-Fldway
WS 100yr - Exist-Fldway
Ground
Ground
Elevation (NAVD88) (ft)
Main Channel Distance (ft)
18
16
14
12
10
8
6
0
100
200
300
400
500
75
115
140
244
309
384
458

APPENDIX D

Existing Conditions

Existing Conditions -Design Flows

```
                  HEC-RAS Version 4.1.0 Jan 2010
                  U.S. Army Corps of Engineers
                  Hydrologic Engineering Center
                        609 Second Street
                        Davis, California

X     X  XXXXXX    XXXX        XXXX      XX     XXXX
X     X  X        X    X       X   X    X  X    X
X     X  X        X            X   X   X    X   X
XXXXXXX  XXXX     X       XXX  XXXX    XXXXXX   XXXX
X     X  X        X            X  X    X    X      X
X     X  X        X    X       X   X   X    X      X
X     X  XXXXXX    XXXX        X    X  X    X  XXXXX
```

PROJECT DATA
Project Title: MysticStreet
Project File : MysticStreet.prj
Run Date and Time: 12/29/2017 12:59:16 PM

Project in English units

Project Description:
Project: Mystic Street Bridge Replacement in Arlington, MA
Done by: LEC and
RSV
Datum: NAVD88

PLAN DATA

Plan Title: Existing-Design
Plan File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.p01

Geometry Title: Existing
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.g01

Flow Title   : Design Flows
Flow File   : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.f03

Plan Description:
Existing conditions with Design Flows.

Plan Summary Information:

Number of:	Cross Sections =	8	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	1	Lateral Structures =	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3

Flow tolerance factor = 0.001

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: Design Flows
Flow File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.f03

Flow Data (cfs)

River	Reach	RS	2yr	5yr	10yr	25yr	50yr	100yr	200yr	500yr
Mill Brook	Main	458	201	338	449	612	750	904	1075	1207

River	Reach	RS	PF 9
Mill Brook	Main	458	570

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Mill Brook	Main	2yr	Normal S = 0.063	Rating Curve #1
Mill Brook	Main	5yr	Normal S = 0.063	Known WS = 10.6
Mill Brook	Main	10yr	Normal S = 0.063	Known WS = 10.8
Mill Brook	Main	25yr	Normal S = 0.063	Known WS = 11.9
Mill Brook	Main	50yr	Normal S = 0.063	Known WS = 11.9
Mill Brook	Main	100yr	Normal S = 0.063	Known WS = 11.9
Mill Brook	Main	200yr	Normal S = 0.063	Known WS = 11.9
Mill Brook	Main	500yr	Normal S = 0.063	Known WS = 11.9

Rating Curve #1

Flow (cfs)	Elev (ft)
150	10
310	10.6
450	10.8
730	11.9

GEOMETRY DATA

Geometry Title: Existing
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.g01

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 458

INPUT
Description: Upstream end of study area (FEMA Cross Section F)
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-73.7	26	-32.7	24.59	-21.7	19.45	-11.2	14.3	-9.3	13.4
0	13.13	14.3	14.37	32.8	24.27				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-73.7	.06	-11.2	.045	14.3	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-11.2	14.3	77	74	70	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 384

INPUT
Description: 204 FT upstream of Mysitc St. Bridge
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-121.1	26	-41.1	24.5	-16.1	17.3	-10.2	13.7	-8.5	12.65
0	12.71	10.9	13.72	24.3	21.76				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-121.1	.06	-10.2	.045	10.9	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-10.2	10.9	67	74	78	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 309

INPUT
Description: 130 ft Upstream of Bridge
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-135	26	-85	24.5	-34	17.3	-16.4	15.82	-14.5	14.8
-13	14	-9.1	12.01	0	11.23	7.4	12.81	12.3	14
15.6	14.8	15.61	17.11	125	19				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-135	.06	-9.1	.045	7.4	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-13	12.3	66	65	65	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 244

INPUT
Description: 65 Upstream of Mystic Bridge
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-115	26	-63	22	-45	18	-33	17.5	-17.5	17.02
-10.1	12.22	0	10.2	12.2	12.44	12.3	17.62	166	19

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-115	.06	-10.1	.045	12.2	.02	12.3	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-17.5	12.3	66	66	66	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 179

INPUT
Description: Upstream face of Mystic Street Bridge
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-186	20	-141	19	-80	17.18	-50	16.8	-22	16
-15.7	15	-13	12.76	-8.61	12.76	-8.6	9	-4.85	8.9
-1	9.6	0	9.2	1	9.2	4.3	9	13.6	8.8
13.61	12.5	13.62	16.48	65.6	16.5	230	17.55	390	19

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-186	.06	-8.61	.02	-8.6	.045	13.6	.02	13.61	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-8.61	13.61	63	63	66	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-186	-8.61	16.7	F
9.6	390	16.7	F

BRIDGE

RIVER: Mill Brook
REACH: Main RS: 140

INPUT
Description: Mystic St. Bridge
Distance from Upstream XS = .5
Deck/Roadway Width = 62
Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates
num= 12

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-107	17.5	0	-50	16.85	0	-9	16.7	0
-9	19.65	0	-8.6	19.65	0	-8.6	19.65	12.5
0	19.65	12.5	9.6	19.65	12.5	9.6	16.7	0
94	17.1	0	230	17.9		390	19.4	

Upstream Bridge Cross Section Data
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-186	20	-141	19	-80	17.18	-50	16.8	-22	16
-15.7	15	-13	12.76	-8.61	12.76	-8.6	9	-4.85	8.9
-1	9.6	0	9.2	1	9.2	4.3	9	13.6	8.8
13.61	12.5	13.62	16.48	65.6	16.5	230	17.55	390	19

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-186	.06	-8.61	.02	-8.6	.045	13.6	.02	13.61	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
-8.61	13.61	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-186	-8.61	16.7	F
9.6	390	16.7	F

Downstream Deck/Roadway Coordinates
num= 12

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-107	17.5	0	-50	16.85	0	-9	16.7	0
-9	19.65	0	-8.6	19.65	0	-8.6	19.65	12.5
0	19.65	12.5	9.6	19.65	12.5	9.6	16.7	0
94	17.1	0	230	17.9		390	19.4	

Downstream Bridge Cross Section Data
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-214	20	-173	19	-114.5	18	-64.5	17	-35	16
-8.61	15.7	-8.6	7.8	-3.8	8.2	-1	8.3	0	8
1	8.7	5.9	8.7	8.8	8.9	17.1	13	23.5	16.25
41.5	16.7	91.5	17	204	17.16	340	19		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-214	.06	-8.61	.02	-8.6	.04	17.1	.07	41.5	.05

Bank Sta: Left	Right	Coeff Contr.	Expan.
-8.61	17.1	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-214	-8.6	16.7	F
9.6	340	16.7	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins = 16.7
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Piers = 1

Pier Data
Pier Station   Upstream=   0   Downstream=   0
Upstream   num=   2

Width	Elev	Width	Elev
2	7	2	12.8

Downstream   num=   2

Width	Elev	Width	Elev
2	7	2	12.8

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd   =
Submerged Inlet + Outlet Cd =   .8
Max Low Cord   =   12.5

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mill Brook
REACH: Main   RS: 115

INPUT
Description: Downstream face of Mystic Street Bridge
Station Elevation Data   num=   19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-214	20	-173	19	-114.5	18	-64.5	17	-35	16
-8.61	15.7	-8.6	7.8	-3.8	8.2	-1	8.3	0	8
1	8.7	5.9	8.7	8.8	8.9	17.1	13	23.5	16.25
41.5	16.7	91.5	17	204	17.16	340	19		

Manning's n Values   num=   5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-214	.06	-8.61	.02	-8.6	.04	17.1	.07	41.5	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-8.61	17.1	45	40	30	.3	.5

Ineffective Flow   num=   2

Sta L	Sta R	Elev	Permanent
-214	-8.6	16.7	F
9.6	340	16.7	F

CROSS SECTION

RIVER: Mill Brook
REACH: Main   RS: 75

INPUT
Description: 40 Downstream of Mystic St. Bridge

Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-5.31	20	-5.3	11	-5.3	8.97	0	8.53	6.7	8.76
8.8	11	13	15.27	30	16	30	20		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-5.31	.02	-5.3	.04	8.8	.07	13	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-5.3	8.8	75	75	74	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 0

INPUT
Description: Downstream End of Model (FEMA Cross-Section E)
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-6.1	20	-6	10	-6	8.33	0	8.44	7	8.71
8.6	10	13.3	13.78	21.4	14	21.4	22.5		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-6.1	.02	-6	.04	8.6	.07	13.3	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-6	8.6	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Mill Brook

Reach	River Sta.	n1	n2	n3	n4	n5
Main	458	.06	.045	.07		
Main	384	.06	.045	.07		
Main	309	.06	.045	.06		
Main	244	.06	.045	.02	.06	
Main	179	.06	.02	.045	.02	.06
Main	140	Bridge				
Main	115	.06	.02	.04	.07	.05
Main	75	.02	.04	.07	.05	
Main	0	.02	.04	.07	.05	

SUMMARY OF REACH LENGTHS

River: Mill Brook

Reach	River Sta.	Left	Channel	Right
Main	458	77	74	70
Main	384	67	74	78
Main	309	66	65	65
Main	244	66	66	66

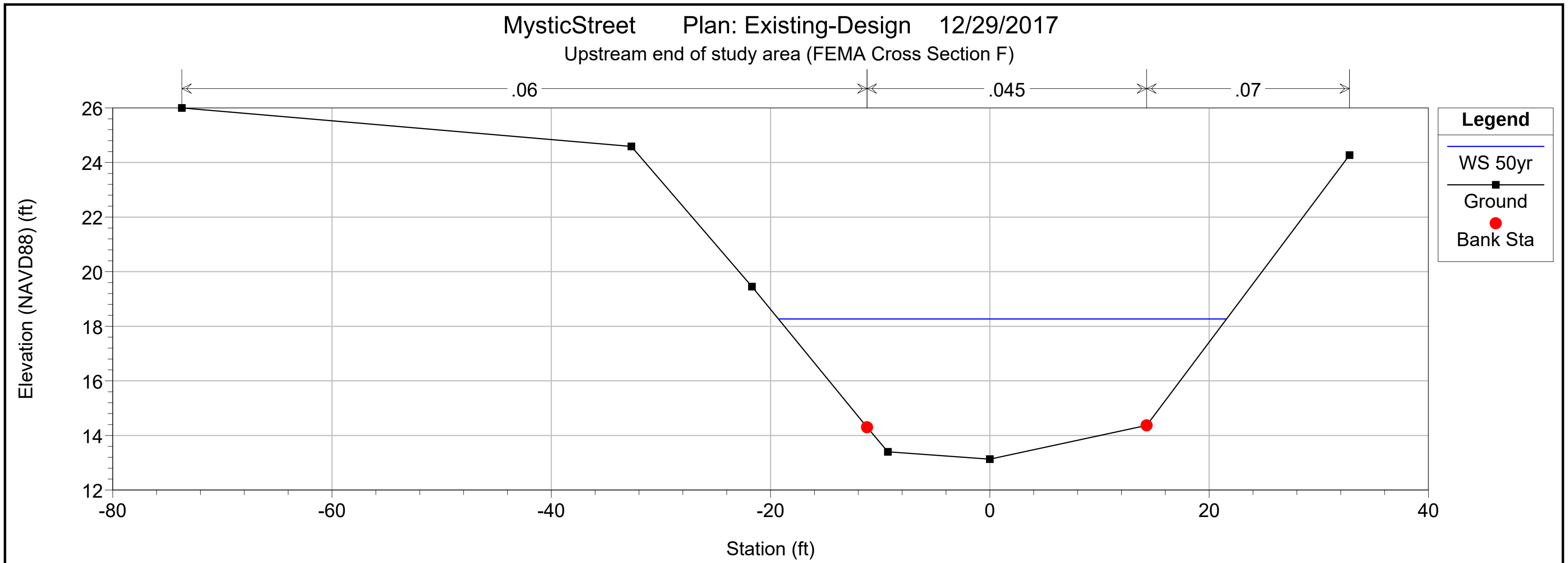
Main	179	63	63	66
Main	140	Bridge		
Main	115	45	40	30
Main	75	75	75	74
Main	0	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Mill Brook

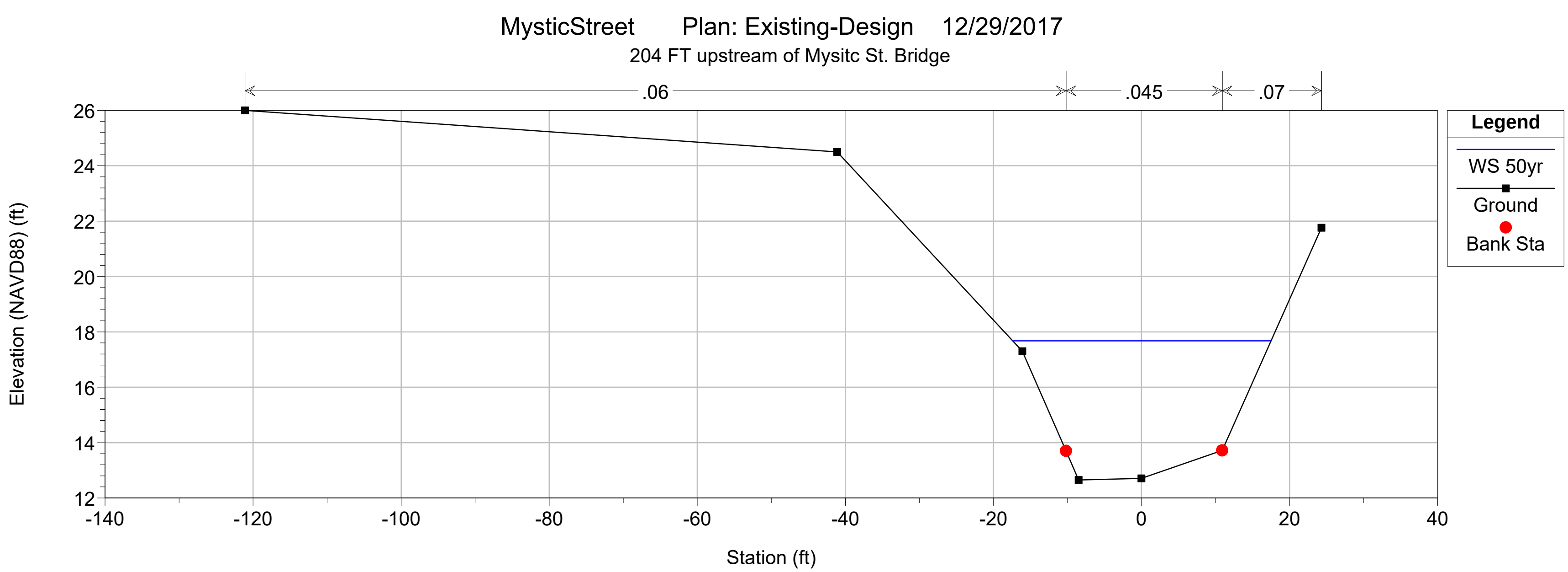
Reach	River Sta.	Contr.	Expan.
Main	458	.1	.3
Main	384	.1	.3
Main	309	.1	.3
Main	244	.1	.3
Main	179	.3	.5
Main	140	Bridge	
Main	115	.3	.5
Main	75	.1	.3
Main	0	.1	.3

HEC-RAS Plan: Exist-Des River: Mill Brook Reach: Main

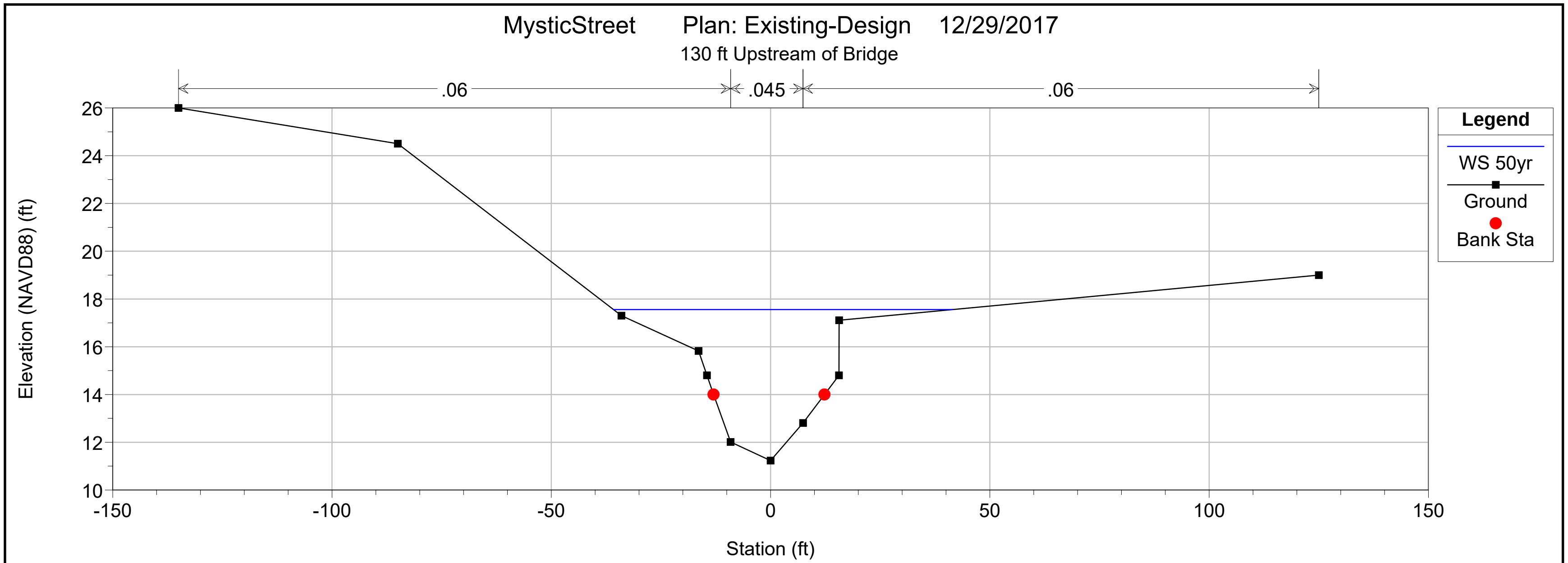
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	0	2yr	201.00	8.33	10.38	10.38	11.29	0.023142	7.64	26.39	15.08	1.00
Main	0	5yr	338.00	8.33	11.14	11.14	12.40	0.020235	9.02	38.13	16.03	0.99
Main	0	10yr	449.00	8.33	11.67	11.67	13.17	0.018853	9.88	46.83	16.69	0.99
Main	0	25yr	612.00	8.33	12.37	12.37	14.19	0.017419	10.89	58.89	17.58	0.99
Main	0	50yr	750.00	8.33	12.93	12.93	14.97	0.016368	11.56	68.88	18.27	0.98
Main	0	100yr	904.00	8.33	13.45	13.45	15.77	0.016138	12.38	78.53	18.92	0.99
Main	0	200yr	1075.00	8.33	14.34	14.34	16.55	0.012526	12.20	99.37	27.44	0.90
Main	0	500yr	1207.00	8.33	14.77	14.77	17.07	0.012053	12.55	111.03	27.45	0.89
Main	75	2yr	201.00	8.53	11.73	10.69	12.11	0.005745	4.98	40.57	14.82	0.52
Main	75	5yr	338.00	8.53	12.63		13.25	0.006464	6.35	54.33	15.70	0.58
Main	75	10yr	449.00	8.53	13.24	12.02	14.04	0.006865	7.23	64.08	16.30	0.61
Main	75	25yr	612.00	8.53	14.01	12.76	15.07	0.007340	8.33	76.93	17.06	0.65
Main	75	50yr	750.00	8.53	14.57	13.34	15.85	0.007712	9.15	86.75	17.62	0.68
Main	75	100yr	904.00	8.53	15.18	13.92	16.67	0.007938	9.93	97.54	18.21	0.70
Main	75	200yr	1075.00	8.53	15.51	14.54	17.40	0.009370	11.16	104.34	23.93	0.76
Main	75	500yr	1207.00	8.53	15.71	15.00	17.93	0.010605	12.12	109.63	28.62	0.82
Main	115	2yr	201.00	7.80	12.14	9.99	12.27	0.001153	2.98	67.46	23.96	0.27
Main	115	5yr	338.00	7.80	13.24	10.64	13.47	0.001368	3.86	87.54	26.18	0.31
Main	115	10yr	449.00	7.80	14.00	11.10	14.30	0.001481	4.43	101.35	27.67	0.33
Main	115	25yr	612.00	7.80	14.98	11.71	15.39	0.001604	5.14	119.16	29.60	0.35
Main	115	50yr	750.00	7.80	15.72	12.18	16.21	0.001687	5.66	132.62	32.56	0.37
Main	115	100yr	904.00	7.80	16.49	12.68	17.08	0.001754	6.17	146.60	82.22	0.38
Main	115	200yr	1075.00	7.80	17.78	13.20	17.98	0.000790	3.96	506.68	353.21	0.24
Main	115	500yr	1207.00	7.80	18.49	13.58	18.61	0.000509	3.35	789.59	445.31	0.19
Main	140		Bridge									
Main	179	2yr	201.00	8.80	12.72	10.63	12.86	0.001643	3.03	66.30	22.22	0.28
Main	179	5yr	338.00	8.80	13.89	11.28	14.13	0.001838	3.86	87.59	27.97	0.31
Main	179	10yr	449.00	8.80	15.32	11.74	15.56	0.001364	3.95	113.58	31.30	0.28
Main	179	25yr	612.00	8.80	17.07	12.36	17.21	0.000639	3.13	292.53	225.49	0.19
Main	179	50yr	750.00	8.80	17.41	12.83	17.58	0.000727	3.44	383.92	296.71	0.21
Main	179	100yr	904.00	8.80	17.69	13.32	17.86	0.000822	3.73	472.83	342.76	0.22
Main	179	200yr	1075.00	8.80	18.02	13.85	18.19	0.000844	3.88	594.54	390.52	0.23
Main	179	500yr	1207.00	8.80	18.51	14.23	18.64	0.000659	3.55	801.80	460.58	0.20
Main	244	2yr	201.00	10.20	12.65	12.64	13.31	0.027808	6.51	30.85	22.96	0.99
Main	244	5yr	338.00	10.20	13.96		14.42	0.009262	5.41	62.44	25.02	0.60
Main	244	10yr	449.00	10.20	15.41		15.72	0.004109	4.48	100.30	27.28	0.41
Main	244	25yr	612.00	10.20	17.05		17.32	0.002578	4.16	147.15	30.82	0.33
Main	244	50yr	750.00	10.20	17.36		17.72	0.003161	4.79	158.31	40.88	0.37
Main	244	100yr	904.00	10.20	17.59		18.06	0.003987	5.52	168.15	47.34	0.42
Main	244	200yr	1075.00	10.20	17.83		18.43	0.004799	6.24	183.27	77.23	0.46
Main	244	500yr	1207.00	10.20	18.27		18.87	0.004441	6.31	229.47	131.31	0.45
Main	309	2yr	201.00	11.23	14.10		14.40	0.010701	4.40	45.69	25.90	0.58
Main	309	5yr	338.00	11.23	14.63		15.13	0.012690	5.69	60.30	29.09	0.66
Main	309	10yr	449.00	11.23	15.68		16.07	0.006219	5.10	92.43	31.74	0.49
Main	309	25yr	612.00	11.23	17.20		17.52	0.003115	4.63	152.89	53.91	0.37
Main	309	50yr	750.00	11.23	17.56		17.95	0.003570	5.19	176.25	77.42	0.40
Main	309	100yr	904.00	11.23	17.85		18.32	0.004082	5.76	202.01	96.65	0.43
Main	309	200yr	1075.00	11.23	18.23		18.74	0.004224	6.12	243.00	121.11	0.44
Main	309	500yr	1207.00	11.23	18.70		19.14	0.003594	5.93	306.16	151.24	0.41
Main	384	2yr	201.00	12.65	14.83		15.23	0.010925	5.12	40.77	24.80	0.67
Main	384	5yr	338.00	12.65	15.45		16.05	0.011409	6.34	56.70	26.84	0.71
Main	384	10yr	449.00	12.65	16.05		16.71	0.009356	6.65	73.52	28.84	0.67
Main	384	25yr	612.00	12.65	17.33		17.88	0.005077	6.18	112.95	33.10	0.52
Main	384	50yr	750.00	12.65	17.67		18.37	0.005796	6.96	124.81	34.89	0.57
Main	384	100yr	904.00	12.65	17.95		18.83	0.006880	7.87	134.47	36.28	0.62
Main	384	200yr	1075.00	12.65	18.24		19.33	0.007907	8.76	145.28	37.79	0.67
Main	384	500yr	1207.00	12.65	18.56		19.75	0.008031	9.19	157.61	39.43	0.69
Main	458	2yr	201.00	13.13	15.58	14.82	15.81	0.005564	3.88	53.93	30.36	0.48
Main	458	5yr	338.00	13.13	16.31	15.34	16.64	0.005354	4.69	77.22	33.22	0.50
Main	458	10yr	449.00	13.13	16.84	15.70	17.24	0.005062	5.13	95.52	35.31	0.50
Main	458	25yr	612.00	13.13	17.81	16.19	18.21	0.003749	5.25	131.59	39.10	0.45
Main	458	50yr	750.00	13.13	18.27	16.55	18.74	0.003915	5.75	149.69	40.87	0.47
Main	458	100yr	904.00	13.13	18.69	16.92	19.25	0.004160	6.28	167.42	42.53	0.49
Main	458	200yr	1075.00	13.13	19.15	17.31	19.79	0.004311	6.77	187.31	44.32	0.51
Main	458	500yr	1207.00	13.13	19.52	17.61	20.22	0.004285	7.04	204.23	45.79	0.51



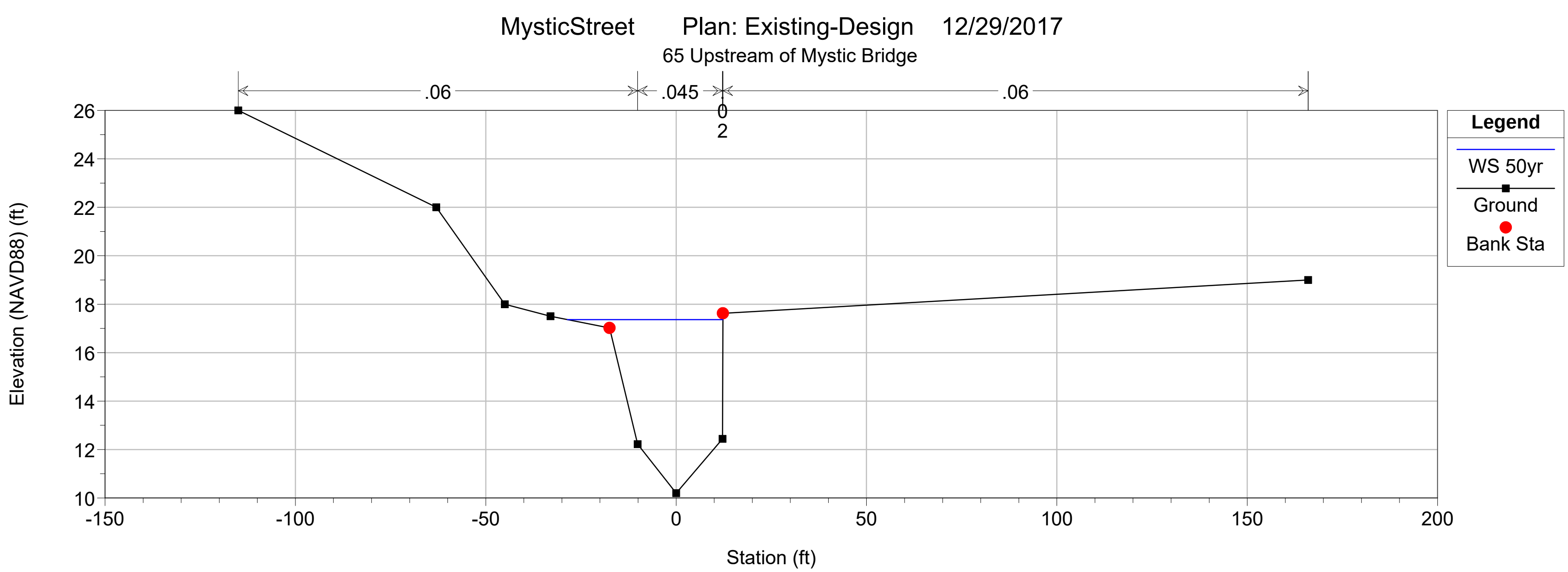
MysticStreet Plan: Existing-Design 12/29/2017
Upstream end of study area (FEMA Cross Section F)
.06
.045
.07
Legend
WS 50yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
26
24
22
20
18
16
14
12
-80
-60
-40
-20
0
20
40
Station (ft)



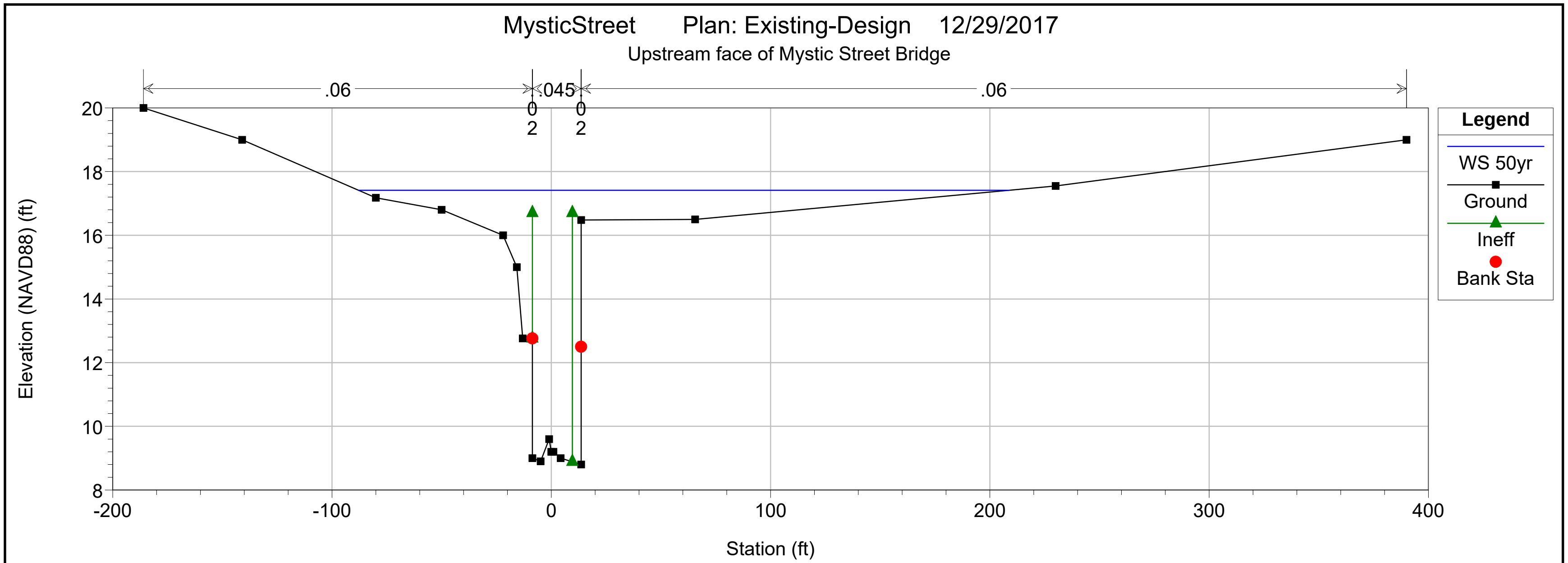
MysticStreet Plan: Existing-Design 12/29/2017
204 FT upstream of Mysitc St. Bridge
.06
.045
.07
Legend
WS 50yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
26
24
22
20
18
16
14
12
-140
-120
-100
-80
-60
-40
-20
0
20
40
Station (ft)

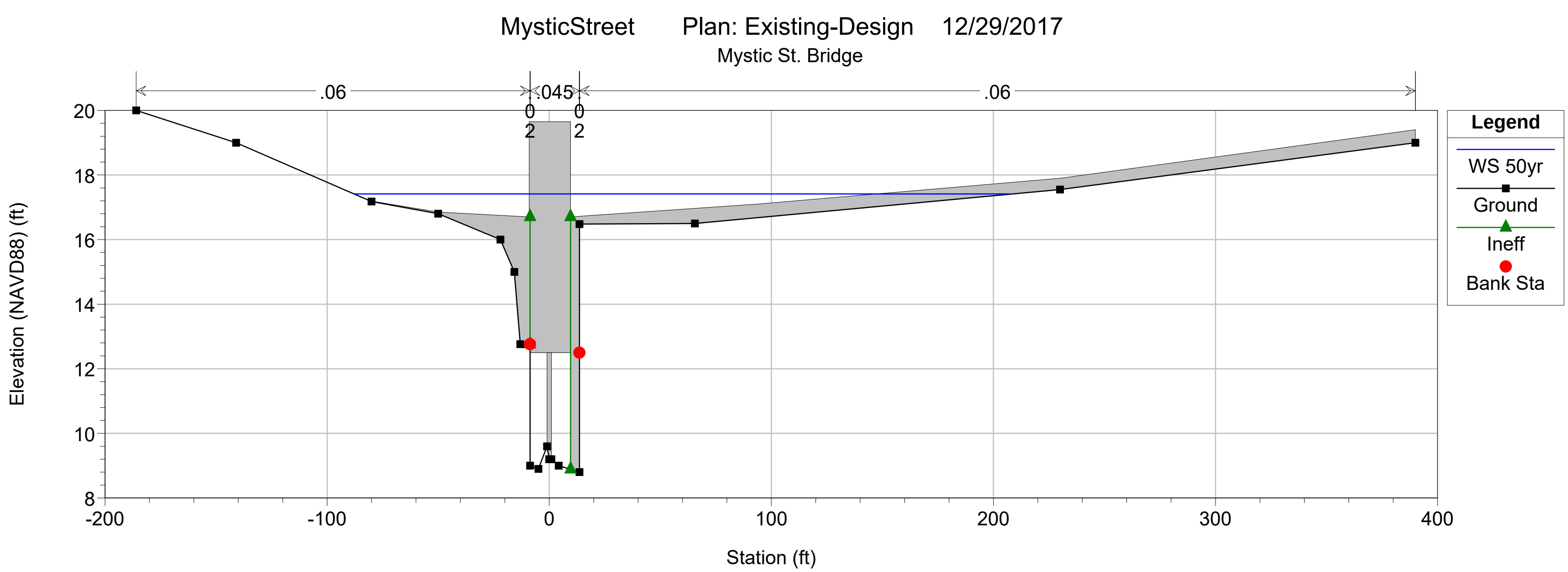


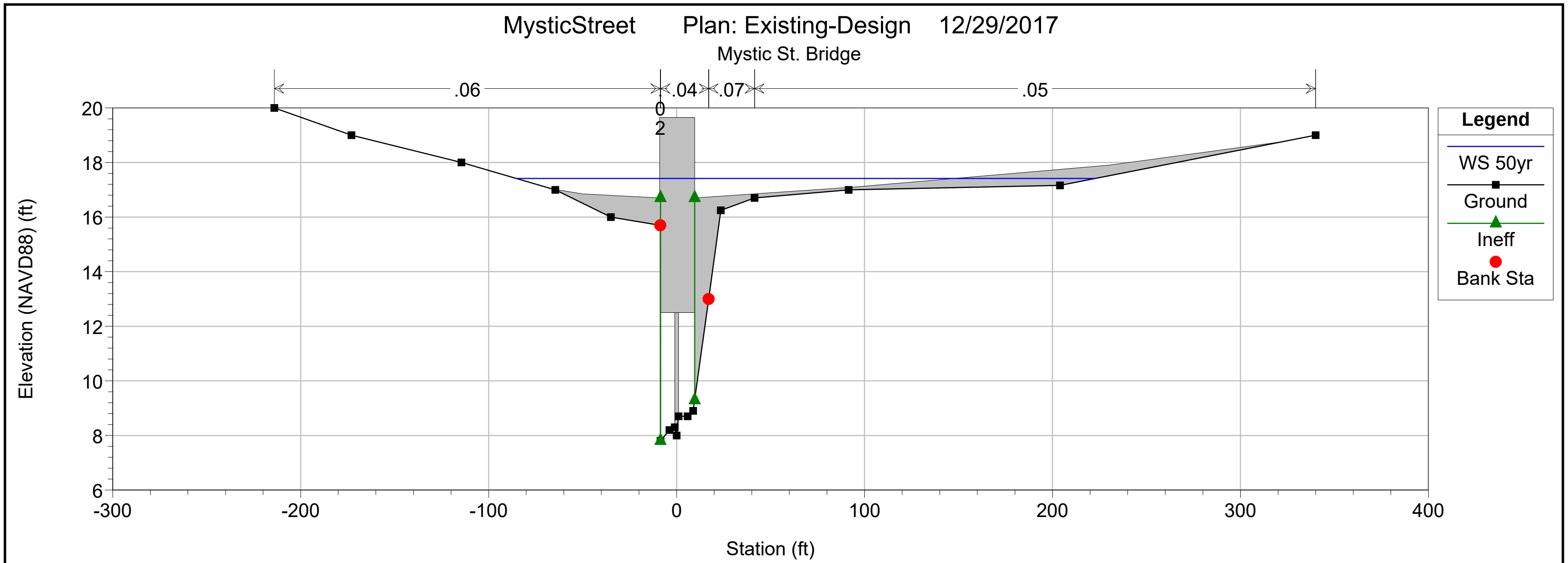
MysticStreet Plan: Existing-Design 12/29/2017
130 ft Upstream of Bridge
.06
.045
.06
Legend
WS 50yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)
26
24
22
20
18
16
14
12
10
-150
-100
-50
0
50
100
150

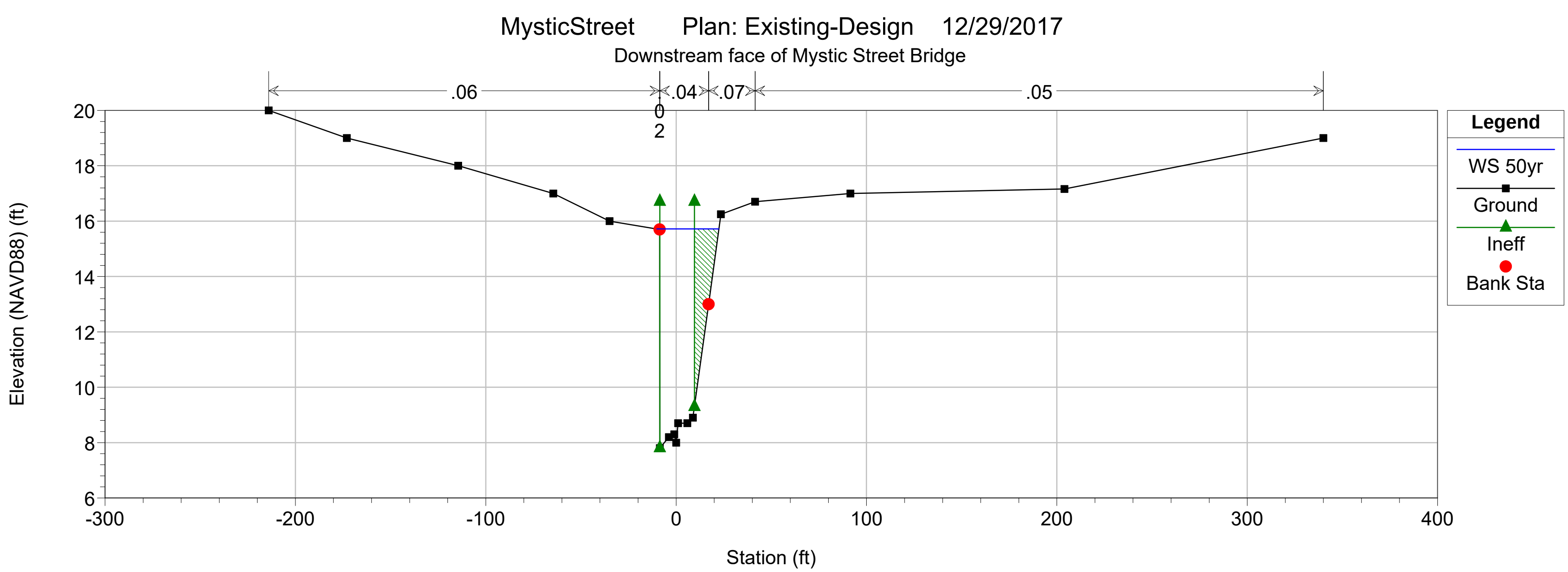


MysticStreet Plan: Existing-Design 12/29/2017
65 Upstream of Mystic Bridge
.06
.045
.06
0
2
Legend
WS 50yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)
26
24
22
20
18
16
14
12
10
-150
-100
-50
0
50
100
150
200

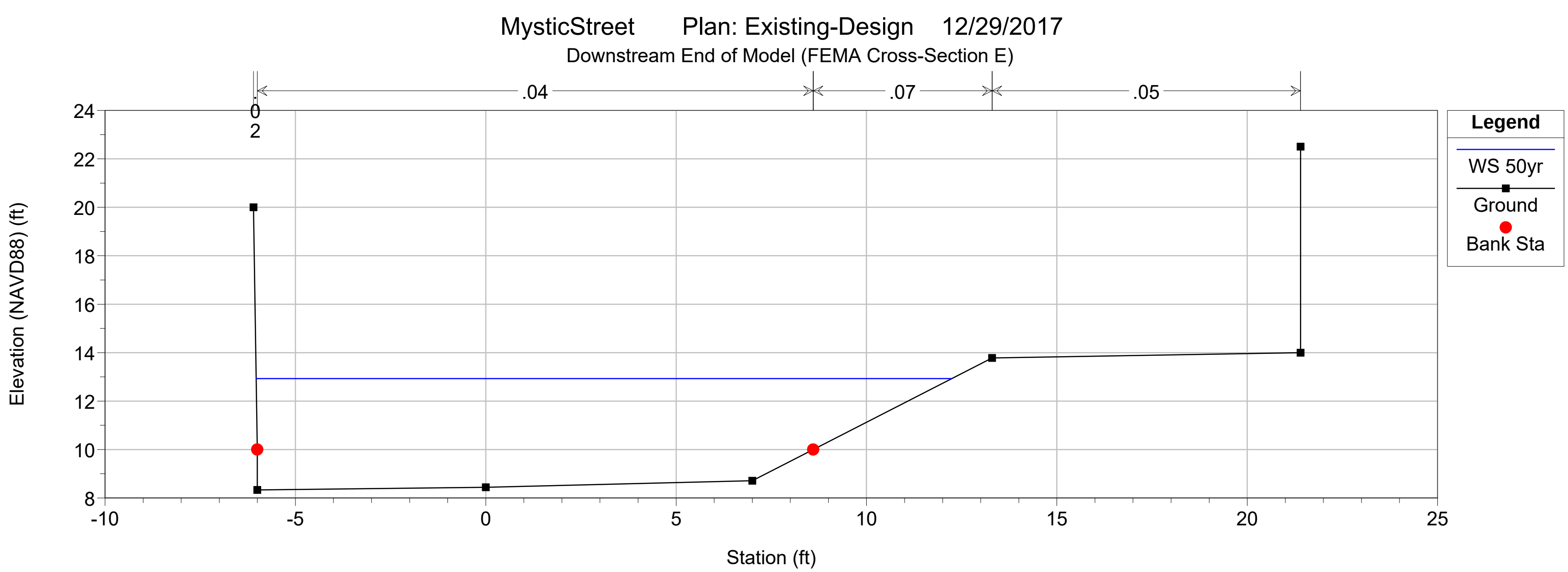

MysticStreet Plan: Existing-Design 12/29/2017
Upstream face of Mystic Street Bridge
.06
.045
.06
0
2
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 50yr
Ground
Ineff
Bank Sta


MysticStreet Plan: Existing-Design 12/29/2017
Mystic St. Bridge
.06
.045
.06
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 50yr
Ground
Ineff
Bank Sta


MysticStreet Plan: Existing-Design 12/29/2017
Mystic St. Bridge
.06
.04
.07
.05
0
2
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 50yr
Ground
Ineff
Bank Sta


MysticStreet Plan: Existing-Design 12/29/2017
Downstream face of Mystic Street Bridge
.06
.04
.07
.05
0
2
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 50yr
Ground
Ineff
Bank Sta


MysticStreet Plan: Existing-Design 12/29/2017
40 Downstream of Mystic St. Bridge
.04
.07
.05
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 50yr
Ground
Bank Sta


MysticStreet Plan: Existing-Design 12/29/2017
Downstream End of Model (FEMA Cross-Section E)
.04
.07
.05
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 50yr
Ground
Bank Sta

Existing Conditions -FEMA Flows

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: MysticStreet
Project File : MysticStreet.prj
Run Date and Time: 12/29/2017 1:04:42 PM

Project in English units

Project Description:
Project: Mystic Street Bridge Replacement in Arlington, MA
Done by: LEC and
RSV
Datum: NAVD88

PLAN DATA

Plan Title: Existing - FEMA
Plan File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.p04

Geometry Title: Existing
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.g01

Flow Title   : FEMA Flows
Flow File   : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.f01

Plan Description:
Existing conditions with FEMA Flows

```
Plan Summary Information:
Number of:  Cross Sections =    8    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    1    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
```

```
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow
```

FLOW DATA

Flow Title: FEMA Flows
Flow File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.f01

Flow Data (cfs)

River	Reach	RS	10yr	50yr	100yr	500yr	200yr
Mill Brook	Main	458	150	310	450	730	540

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Mill Brook	Main	10yr	Normal S = 0.063	Known WS = 10
Mill Brook	Main	50yr	Normal S = 0.063	Known WS = 10.6
Mill Brook	Main	100yr	Normal S = 0.063	Known WS = 10.8
Mill Brook	Main	500yr	Normal S = 0.063	Known WS = 11.9
Mill Brook	Main	200yr	Normal S = 0.063	Known WS = 11.5

GEOMETRY DATA

Geometry Title: Existing
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.g01

CROSS SECTION

RIVER: Mill Brook
REACH: Main   RS: 458

INPUT
Description: Upstream end of study area (FEMA Cross Section F)
Station Elevation Data   num=   8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-73.7	26	-32.7	24.59	-21.7	19.45	-11.2	14.3	-9.3	13.4
0	13.13	14.3	14.37	32.8	24.27				

```
Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   -73.7     .06   -11.2    .045    14.3     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -11.2    14.3               77      74      70              .1       .3
```

CROSS SECTION

```
RIVER: Mill Brook
REACH: Main               RS: 384

INPUT
Description: 204 FT upstream of Mysitc St. Bridge
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -121.1      26   -41.1    24.5   -16.1    17.3   -10.2    13.7    -8.5   12.65
       0   12.71    10.9   13.72    24.3   21.76

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  -121.1     .06   -10.2    .045    10.9     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -10.2    10.9               67      74      78              .1       .3
```

CROSS SECTION

```
RIVER: Mill Brook
REACH: Main               RS: 309

INPUT
Description: 130 ft Upstream of Bridge
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    -135      26     -85    24.5     -34    17.3   -16.4   15.82   -14.5    14.8
     -13      14    -9.1   12.01       0   11.23     7.4   12.81    12.3      14
    15.6    14.8   15.61   17.11     125      19

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    -135     .06    -9.1    .045     7.4     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           -13    12.3               66      65      65              .1       .3
```

CROSS SECTION

```
RIVER: Mill Brook
REACH: Main               RS: 244

INPUT
Description: 65 Upstream of Mystic Bridge
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    -115      26     -63      22     -45      18     -33    17.5   -17.5   17.02
   -10.1   12.22       0    10.2    12.2   12.44    12.3   17.62     166      19

Manning's n Values         num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
```

-115	.06	-10.1	.045	12.2	.02	12.3	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-17.5	12.3	66	66	66	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 179

INPUT
Description: Upstream face of Mystic Street Bridge
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-186	20	-141	19	-80	17.18	-50	16.8	-22	16
-15.7	15	-13	12.76	-8.61	12.76	-8.6	9	-4.85	8.9
-1	9.6	0	9.2	1	9.2	4.3	9	13.6	8.8
13.61	12.5	13.62	16.48	65.6	16.5	230	17.55	390	19

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-186	.06	-8.61	.02	-8.6	.045	13.6	.02	13.61	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-8.61	13.61	63	63	66	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-186	-8.61	16.7	F
9.6	390	16.7	F

BRIDGE

RIVER: Mill Brook
REACH: Main RS: 140

INPUT
Description: Mystic St. Bridge
Distance from Upstream XS = .5
Deck/Roadway Width = 62
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 12

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-107	17.5	0	-50	16.85	0	-9	16.7	0
-9	19.65	0	-8.6	19.65	0	-8.6	19.65	12.5
0	19.65	12.5	9.6	19.65	12.5	9.6	16.7	0
94	17.1	0	230	17.9		390	19.4	

Upstream Bridge Cross Section Data
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-186	20	-141	19	-80	17.18	-50	16.8	-22	16
-15.7	15	-13	12.76	-8.61	12.76	-8.6	9	-4.85	8.9
-1	9.6	0	9.2	1	9.2	4.3	9	13.6	8.8
13.61	12.5	13.62	16.48	65.6	16.5	230	17.55	390	19

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-186	.06	-8.61	.02	-8.6	.045	13.6	.02	13.61	.06

Bank Sta: Left Right Coeff Contr. Expan.

```
         -8.61   13.61             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    -186   -8.61    16.7       F
     9.6     390    16.7       F

Downstream  Deck/Roadway Coordinates
    num=      12
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    -107    17.5       0     -50   16.85       0      -9    16.7       0
      -9   19.65       0    -8.6   19.65       0    -8.6   19.65    12.5
       0   19.65    12.5     9.6   19.65    12.5     9.6    16.7       0
      94    17.1       0     230    17.9             390    19.4

Downstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    -214      20    -173      19  -114.5      18   -64.5      17     -35      16
   -8.61    15.7    -8.6     7.8    -3.8     8.2      -1     8.3       0       8
       1     8.7     5.9     8.7     8.8     8.9    17.1      13    23.5   16.25
    41.5    16.7    91.5      17     204   17.16     340      19

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
    -214     .06   -8.61     .02    -8.6     .04    17.1     .07    41.5     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -8.61    17.1             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    -214    -8.6    16.7       F
     9.6     340    16.7       F

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =    16.7
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=       0    Downstream=       0
Upstream     num=       2
    Width   Elev    Width   Elev
       2       7       2    12.8
Downstream     num=       2
    Width   Elev    Width   Elev
       2       7       2    12.8

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =      .8
           Max Low Cord                =    12.5
```

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 115

INPUT
Description: Downstream face of Mystic Street Bridge
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-214	20	-173	19	-114.5	18	-64.5	17	-35	16
-8.61	15.7	-8.6	7.8	-3.8	8.2	-1	8.3	0	8
1	8.7	5.9	8.7	8.8	8.9	17.1	13	23.5	16.25
41.5	16.7	91.5	17	204	17.16	340	19		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-214	.06	-8.61	.02	-8.6	.04	17.1	.07	41.5	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-8.61	17.1	45	40	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-214	-8.6	16.7	F
9.6	340	16.7	F

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 75

INPUT
Description: 40 Downstream of Mystic St. Bridge
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-5.31	20	-5.3	11	-5.3	8.97	0	8.53	6.7	8.76
8.8	11	13	15.27	30	16	30	20		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-5.31	.02	-5.3	.04	8.8	.07	13	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-5.3	8.8	75	75	74	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 0

INPUT
Description: Downstream End of Model (FEMA Cross-Section E)
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-6.1	20	-6	10	-6	8.33	0	8.44	7	8.71
8.6	10	13.3	13.78	21.4	14	21.4	22.5		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-6.1	.02	-6	.04	8.6	.07	13.3	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-6	8.6	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Mill Brook

Reach	River Sta.	n1	n2	n3	n4	n5
Main	458	.06	.045	.07		
Main	384	.06	.045	.07		
Main	309	.06	.045	.06		
Main	244	.06	.045	.02	.06	
Main	179	.06	.02	.045	.02	.06
Main	140	Bridge				
Main	115	.06	.02	.04	.07	.05
Main	75	.02	.04	.07	.05	
Main	0	.02	.04	.07	.05	

SUMMARY OF REACH LENGTHS

River: Mill Brook

Reach	River Sta.	Left	Channel	Right
Main	458	77	74	70
Main	384	67	74	78
Main	309	66	65	65
Main	244	66	66	66
Main	179	63	63	66
Main	140	Bridge		
Main	115	45	40	30
Main	75	75	75	74
Main	0	0	0	0

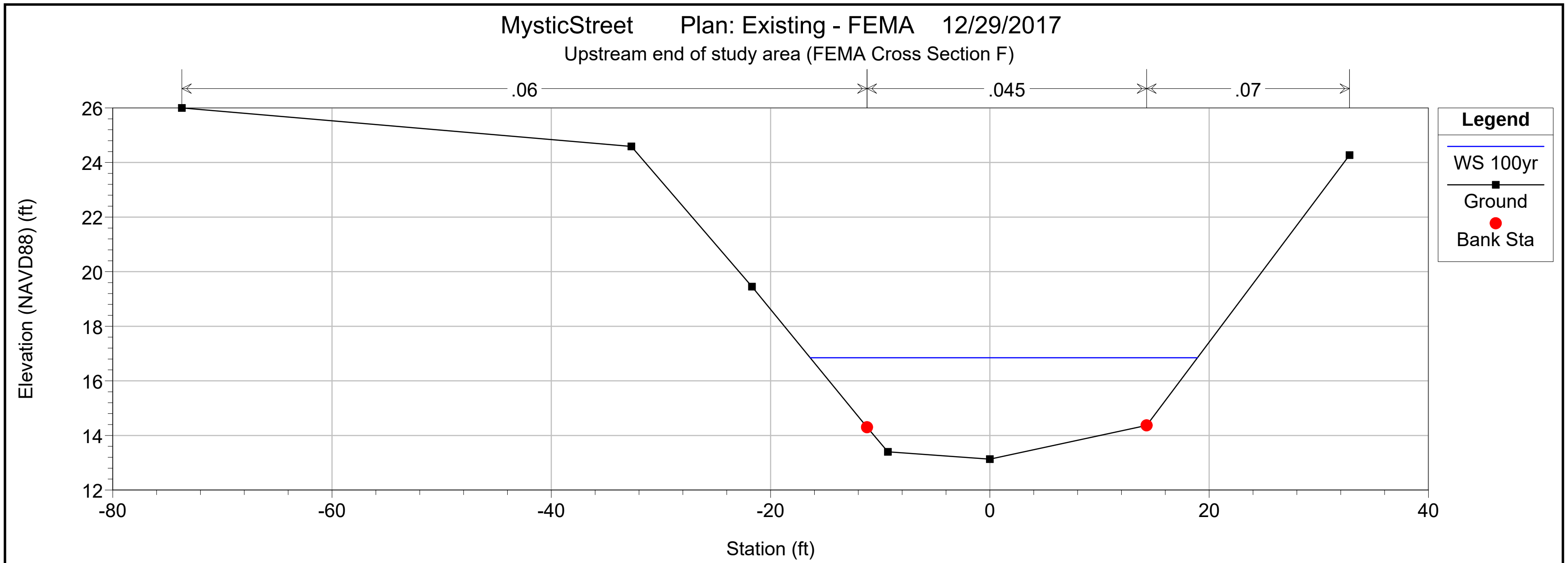
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Mill Brook

Reach	River Sta.	Contr.	Expan.
Main	458	.1	.3
Main	384	.1	.3
Main	309	.1	.3
Main	244	.1	.3
Main	179	.3	.5
Main	140	Bridge	

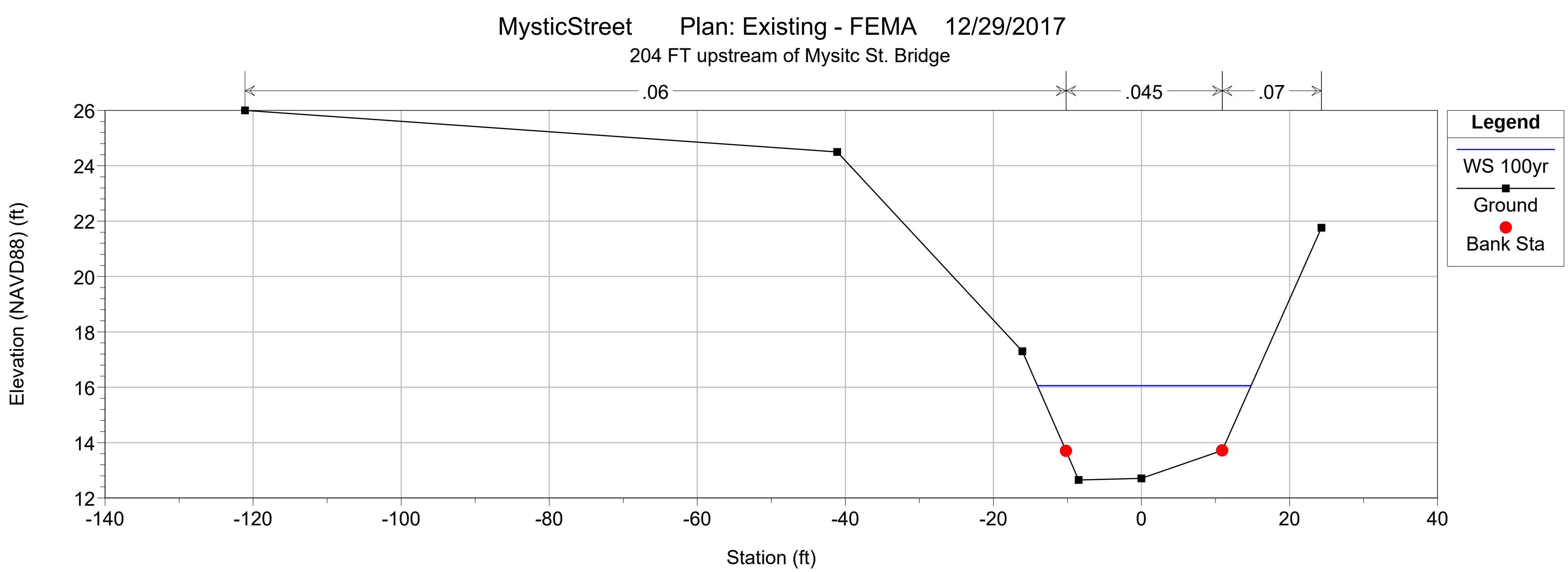
Main	**115**	**.3**	**.5**
Main	**75**	**.1**	**.3**
Main	**0**	**.1**	**.3**

HEC-RAS Plan: Exist-FEMA River: Mill Brook Reach: Main

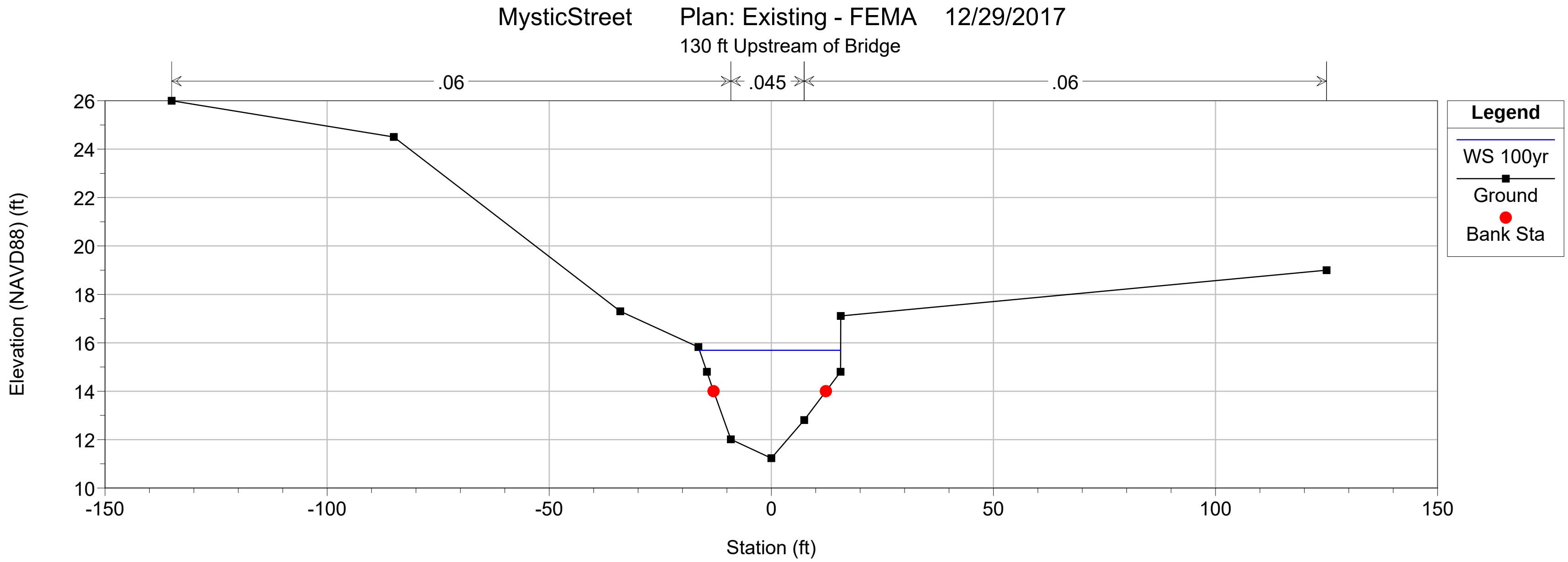
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	0	10yr	150.00	8.33	10.07	10.07	10.81	0.024644	6.93	21.66	14.68	1.00
Main	0	50yr	310.00	8.33	11.00	11.00	12.19	0.020657	8.77	35.85	15.85	1.00
Main	0	100yr	450.00	8.33	11.67	11.67	13.18	0.018842	9.88	46.90	16.70	0.99
Main	0	500yr	730.00	8.33	12.86	12.86	14.86	0.016461	11.46	67.51	18.18	0.98
Main	75	10yr	150.00	8.53	11.31	10.35	11.61	0.005396	4.35	34.52	14.41	0.49
Main	75	50yr	310.00	8.53	12.46		13.04	0.006347	6.10	51.70	15.54	0.57
Main	75	100yr	450.00	8.53	13.24	12.03	14.05	0.006868	7.23	64.16	16.31	0.61
Main	75	500yr	730.00	8.53	14.50	13.26	15.74	0.007657	9.04	85.39	17.54	0.67
Main	115	10yr	150.00	7.80	11.64	9.71	11.74	0.001035	2.57	58.47	22.96	0.25
Main	115	50yr	310.00	7.80	13.03	10.51	13.24	0.001333	3.70	83.76	25.77	0.30
Main	115	100yr	450.00	7.80	14.01	11.10	14.31	0.001482	4.44	101.47	27.69	0.33
Main	115	500yr	730.00	7.80	15.61	12.11	16.10	0.001675	5.58	130.75	30.86	0.37
Main	140		Bridge									
Main	179	10yr	150.00	8.80	11.83	10.36	11.97	0.002285	2.99	50.11	22.22	0.32
Main	179	50yr	310.00	8.80	13.55	11.16	13.78	0.001978	3.81	81.35	27.56	0.32
Main	179	100yr	450.00	8.80	15.33	11.74	15.58	0.001360	3.95	113.82	31.39	0.28
Main	179	500yr	730.00	8.80	17.37	12.76	17.54	0.000713	3.39	372.20	289.11	0.21
Main	244	10yr	150.00	10.20	12.38	12.38	12.95	0.030274	6.06	24.73	22.21	1.01
Main	244	50yr	310.00	10.20	13.61		14.13	0.012287	5.78	53.59	24.46	0.69
Main	244	100yr	450.00	10.20	15.43		15.74	0.004085	4.47	100.67	27.30	0.41
Main	244	500yr	730.00	10.20	17.33		17.67	0.003061	4.69	156.95	39.79	0.36
Main	309	10yr	150.00	11.23	13.80		14.04	0.009984	3.94	38.08	24.06	0.55
Main	309	50yr	310.00	11.23	14.48		14.96	0.013453	5.60	55.89	28.17	0.67
Main	309	100yr	450.00	11.23	15.69		16.08	0.006173	5.09	92.80	31.76	0.49
Main	309	500yr	730.00	11.23	17.52		17.89	0.003497	5.11	173.05	74.69	0.39
Main	384	10yr	150.00	12.65	14.52		14.85	0.011405	4.62	33.26	23.78	0.66
Main	384	50yr	310.00	12.65	15.33		15.90	0.011320	6.12	53.65	26.46	0.71
Main	384	100yr	450.00	12.65	16.06		16.72	0.009314	6.65	73.75	28.87	0.67
Main	384	500yr	730.00	12.65	17.63		18.31	0.005664	6.84	123.40	34.68	0.56
Main	458	10yr	150.00	13.13	15.25		15.44	0.005654	3.48	44.34	29.10	0.47
Main	458	50yr	310.00	13.13	16.17		16.48	0.005384	4.54	72.71	32.69	0.50
Main	458	100yr	450.00	13.13	16.85		17.24	0.005056	5.14	95.71	35.33	0.50
Main	458	500yr	730.00	13.13	18.21		18.67	0.003880	5.67	147.30	40.64	0.46



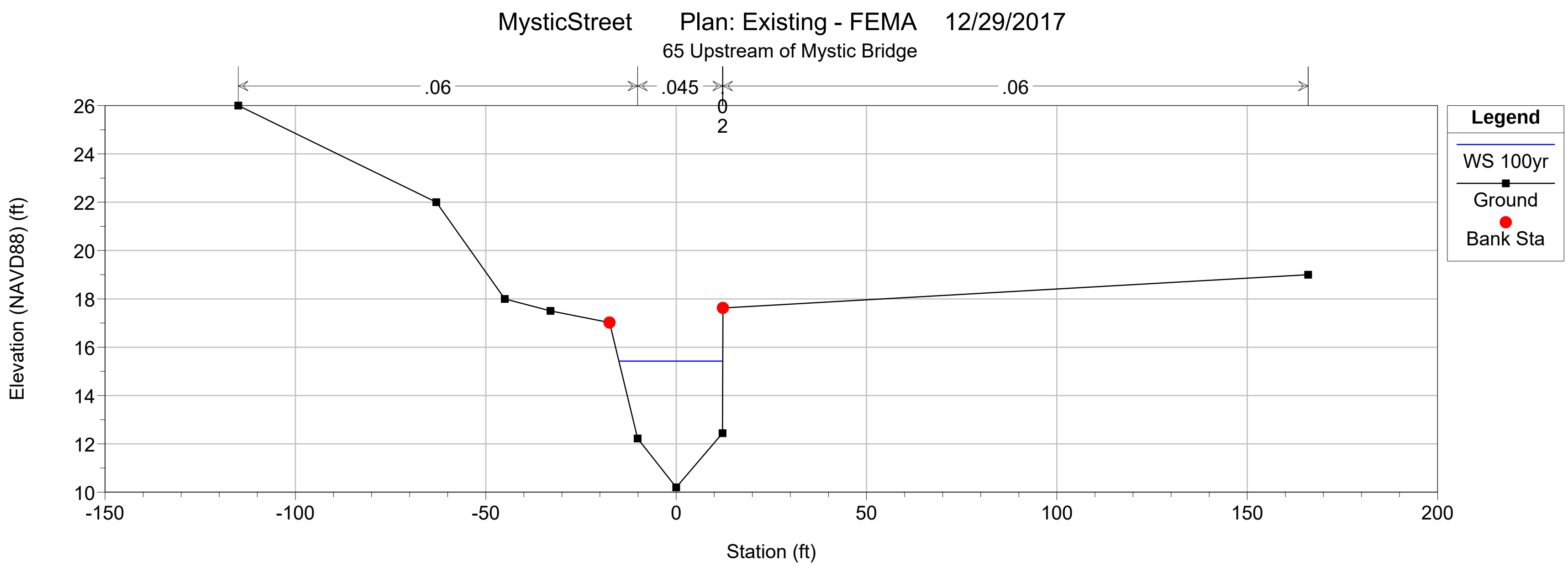
MysticStreet Plan: Existing - FEMA 12/29/2017
Upstream end of study area (FEMA Cross Section F)
.06
.045
.07
Legend
WS 100yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
26
24
22
20
18
16
14
12
-80
-60
-40
-20
0
20
40
Station (ft)



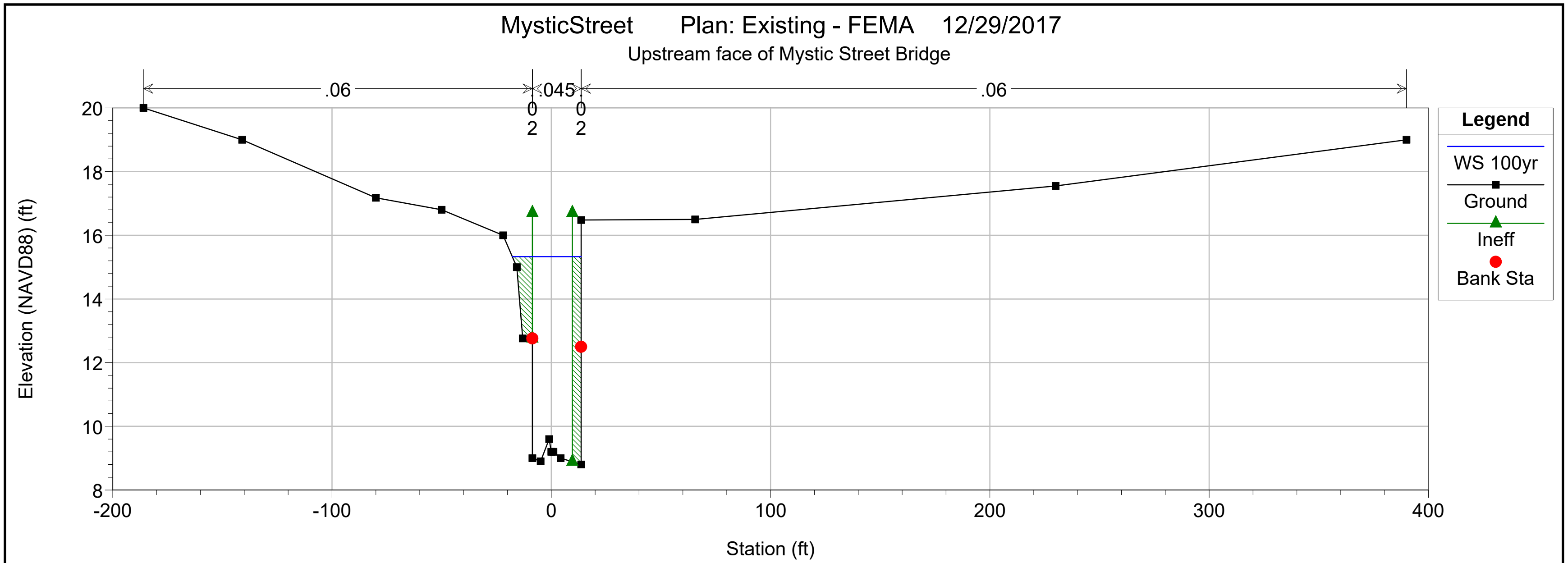
MysticStreet Plan: Existing - FEMA 12/29/2017
204 FT upstream of Mysitc St. Bridge
.06
.045
.07
Legend
WS 100yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
26
24
22
20
18
16
14
12
-140
-120
-100
-80
-60
-40
-20
0
20
40
Station (ft)



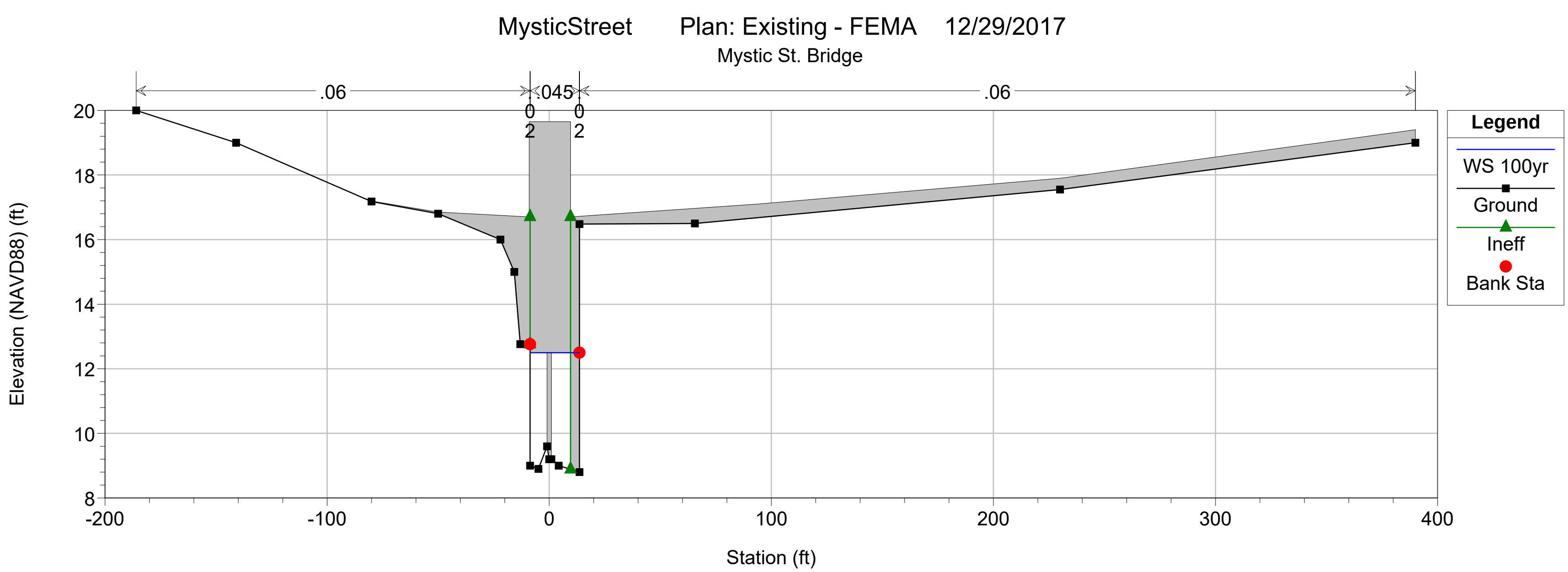
MysticStreet Plan: Existing - FEMA 12/29/2017
130 ft Upstream of Bridge
.06
.045
.06
Legend
WS 100yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)



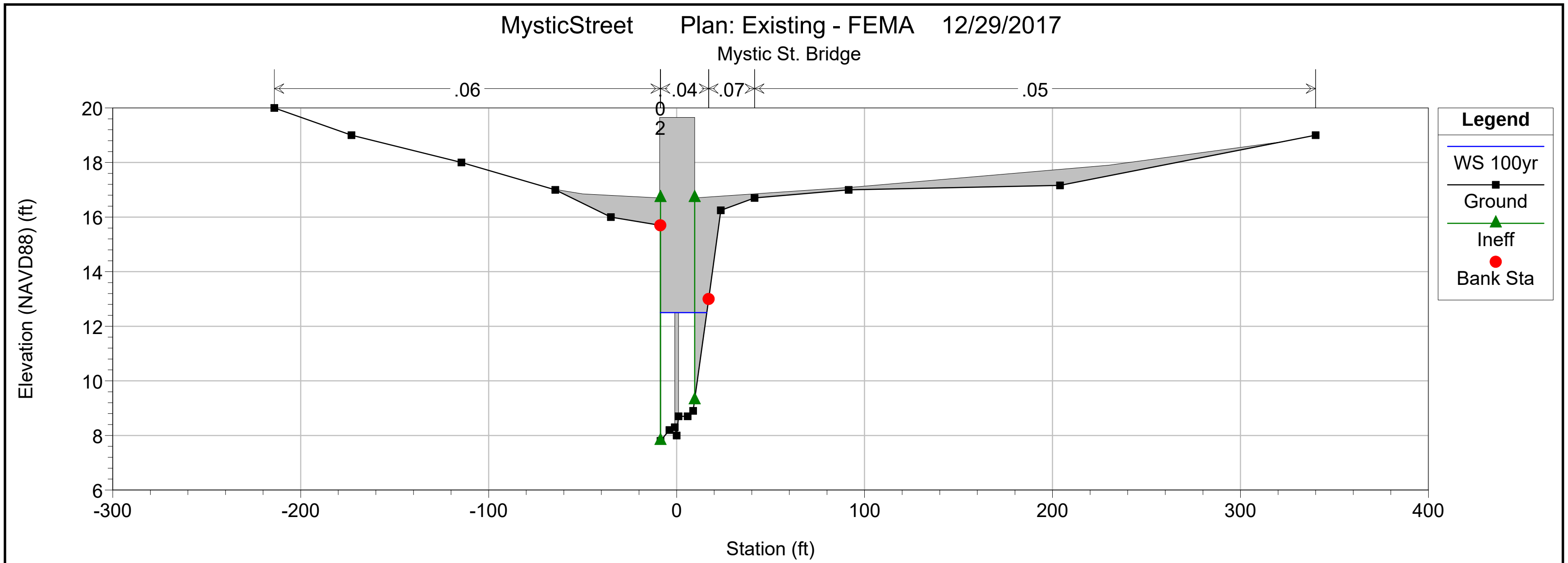
MysticStreet Plan: Existing - FEMA 12/29/2017
65 Upstream of Mystic Bridge
.06
.045
0
2
.06
Legend
WS 100yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)



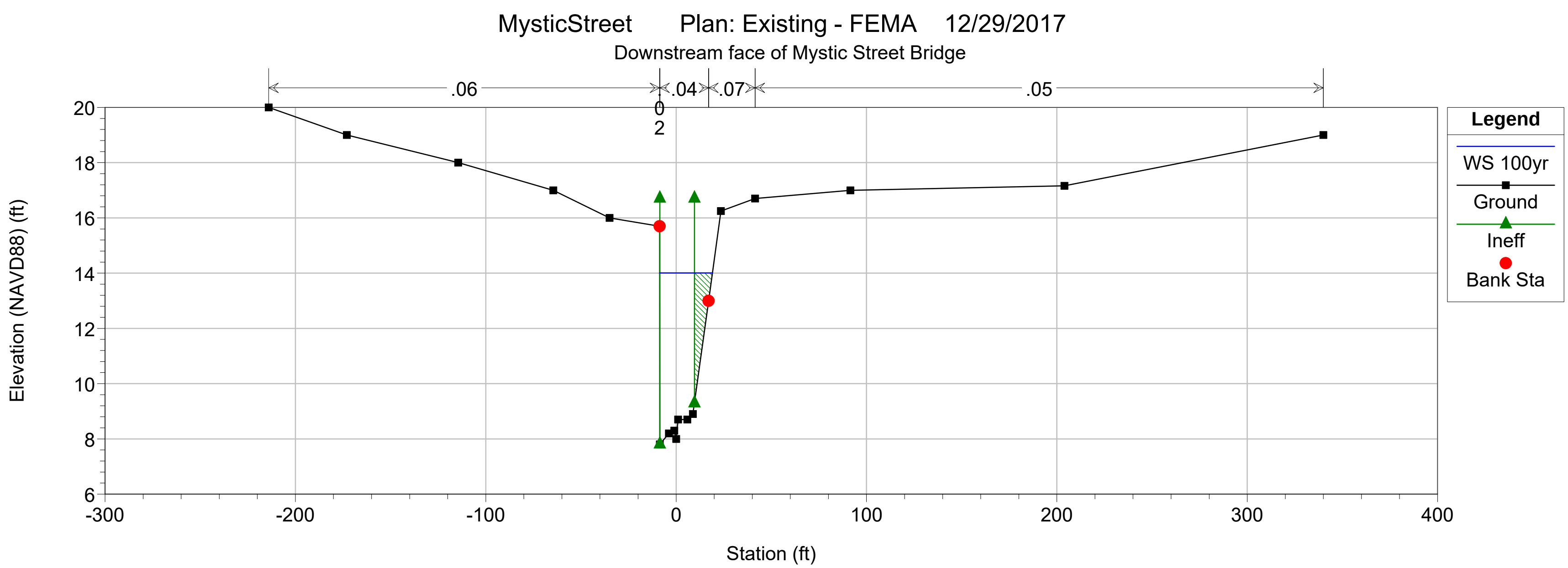
MysticStreet Plan: Existing - FEMA 12/29/2017
Upstream face of Mystic Street Bridge
.06
.045
.06
0
2
0
2
Elevation (NAVD88) (ft)
Station (ft)
20
18
16
14
12
10
8
-200
-100
0
100
200
300
400
Legend
WS 100yr
Ground
Ineff
Bank Sta



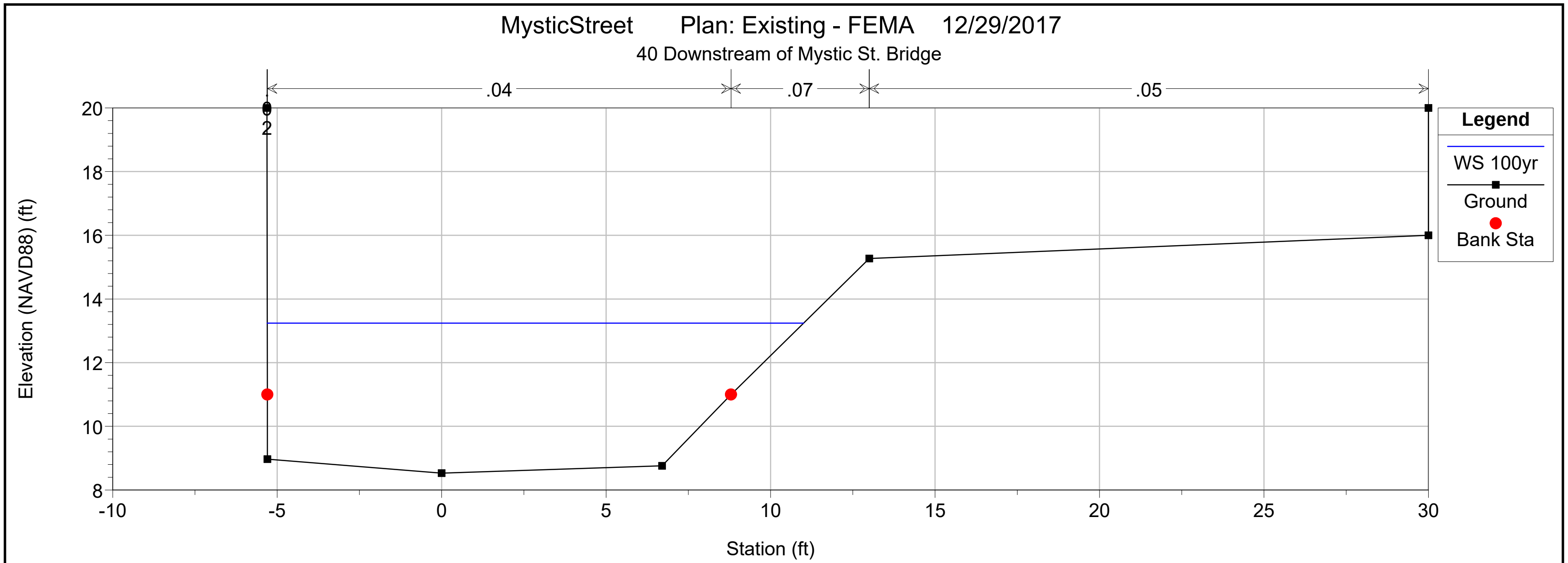
MysticStreet Plan: Existing - FEMA 12/29/2017
Mystic St. Bridge
.06
.045
.06
0
2
0
2
Elevation (NAVD88) (ft)
Station (ft)
20
18
16
14
12
10
8
-200
-100
0
100
200
300
400
Legend
WS 100yr
Ground
Ineff
Bank Sta

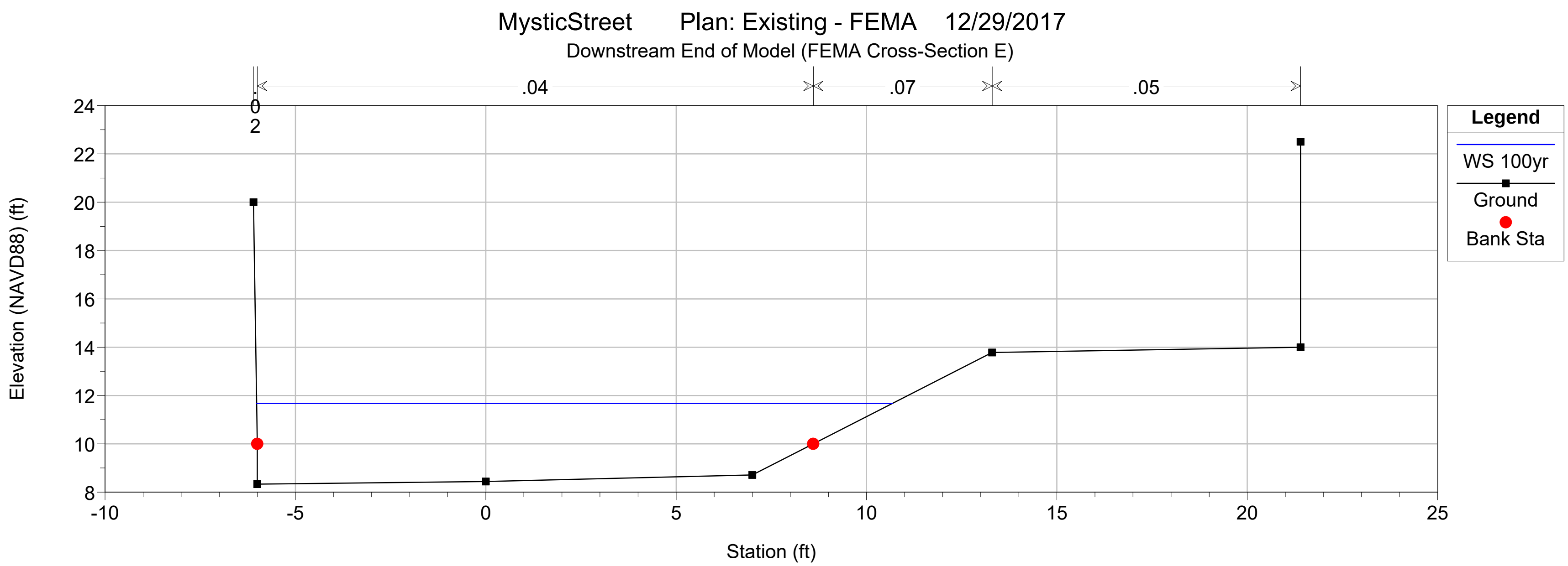


MysticStreet Plan: Existing - FEMA 12/29/2017
Mystic St. Bridge
.06
.04
.07
.05
0
2
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
Ground
Ineff
Bank Sta



MysticStreet Plan: Existing - FEMA 12/29/2017
Downstream face of Mystic Street Bridge
.06
.04
.07
.05
0
2
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
Ground
Ineff
Bank Sta


MysticStreet Plan: Existing - FEMA 12/29/2017
40 Downstream of Mystic St. Bridge
.04
.07
.05
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
Ground
Bank Sta


MysticStreet Plan: Existing - FEMA 12/29/2017
Downstream End of Model (FEMA Cross-Section E)
.04
.07
.05
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
Ground
Bank Sta

Existing Conditions -Floodway

```
                    HEC-RAS Version 4.1.0 Jan 2010
                     U.S. Army Corps of Engineers
                    Hydrologic Engineering Center
                          609 Second Street
                          Davis, California

     X     X  XXXXXX   XXXX        XXXX     XX    XXXX
     X     X  X       X    X       X   X   X  X  X
     X     X  X       X            X   X  X    X X
     XXXXXXX  XXXX    X      XXX   XXXX   XXXXXX  XXXX
     X     X  X       X            X  X   X    X      X
     X     X  X       X    X       X   X  X    X      X
     X     X  XXXXXX   XXXX        X    X X    X XXXXX
```

PROJECT DATA
Project Title: MysticStreet
Project File : MysticStreet.prj
Run Date and Time: 12/29/2017 1:08:15 PM

Project in English units

Project Description:
Project: Mystic Street Bridge Replacement in Arlington, MA
Done by: LEC and
RSV
Datum: NAVD88

PLAN DATA

Plan Title: Existing - Floodway
Plan File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.p06

Geometry Title: Existing
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.g01

Flow Title   : FEMA Floodway Flows
Flow File   : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.f02

Plan Description:
Existing conditions with FEMA Floodway Flows

Plan Summary Information:

Number of:	Cross Sections	=	8	Multiple Openings	=	0
	Culverts	=	0	Inline Structures	=	0
	Bridges	=	1	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	=	0.01
Critical depth calculation tolerance	=	0.01
Maximum number of iterations	=	20
Maximum difference tolerance	=	0.3

Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = Mill Brook Reach = Main

RS	Profile	Method	Value1	Value2
458	100yr Floodway	1	-17	22
384	100yr Floodway	1	-36	24
309	100yr Floodway	1	-38	48
244	100yr Floodway	1	-25	35
179	100yr Floodway	1	-45	25
115	100yr Floodway	1	-25	17
75	100yr Floodway	1	-25	11
0	100yr Floodway	1	-45	18

FLOW DATA

Flow Title: FEMA Floodway Flows
Flow File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.f02

Flow Data (cfs)

River	Reach	RS	100yr	100yr Floodway
Mill Brook	Main	458	450	450

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Mill Brook	Main	100yr	Normal S = 0.063	Known WS = 10.8
Mill Brook	Main	100yr Floodway	Normal S = 0.063	Known WS = 10.9

GEOMETRY DATA

Geometry Title: Existing
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.g01

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 458

INPUT
Description: Upstream end of study area (FEMA Cross Section F)
Station Elevation Data   num=   8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-73.7	26	-32.7	24.59	-21.7	19.45	-11.2	14.3	-9.3	13.4
0	13.13	14.3	14.37	32.8	24.27				

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
-73.7	.06	-11.2	.045	14.3	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-11.2	14.3	77	74	70	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main   RS: 384

INPUT
Description: 204 FT upstream of Mysitc St. Bridge
Station Elevation Data   num=   8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-121.1	26	-41.1	24.5	-16.1	17.3	-10.2	13.7	-8.5	12.65
0	12.71	10.9	13.72	24.3	21.76				

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
-121.1	.06	-10.2	.045	10.9	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-10.2	10.9	67	74	78	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main   RS: 309

INPUT
Description: 130 ft Upstream of Bridge
Station Elevation Data   num=   13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-135	26	-85	24.5	-34	17.3	-16.4	15.82	-14.5	14.8
-13	14	-9.1	12.01	0	11.23	7.4	12.81	12.3	14
15.6	14.8	15.61	17.11	125	19				

Manning's n Values   num=   3

Sta	n Val	Sta	n Val	Sta	n Val
-135	.06	-9.1	.045	7.4	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-13	12.3	66	65	65	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main   RS: 244

INPUT

```
Description: 65 Upstream of Mystic Bridge
Station Elevation Data    num=      10
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    -115       26      -63       22      -45       18      -33     17.5    -17.5    17.02
   -10.1    12.22        0     10.2     12.2    12.44     12.3    17.62      166       19

Manning's n Values        num=       4
     Sta    n Val      Sta    n Val      Sta    n Val      Sta    n Val
    -115      .06    -10.1     .045     12.2      .02     12.3      .06

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
         -17.5    12.3                 66       66      66              .1       .3

CROSS SECTION


RIVER: Mill Brook
REACH: Main               RS: 179

INPUT
Description: Upstream face of Mystic Street Bridge
Station Elevation Data    num=      20
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    -186       20     -141       19      -80    17.18      -50     16.8      -22       16
   -15.7       15      -13    12.76    -8.61    12.76     -8.6        9    -4.85      8.9
      -1      9.6        0      9.2        1      9.2      4.3        9     13.6      8.8
   13.61     12.5    13.62    16.48     65.6     16.5      230    17.55      390       19

Manning's n Values        num=       5
     Sta    n Val      Sta    n Val      Sta    n Val      Sta    n Val      Sta    n Val
    -186      .06    -8.61      .02     -8.6     .045     13.6      .02    13.61      .06

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
         -8.61   13.61                 63       63      66              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    -186   -8.61    16.7       F
     9.6     390    16.7       F

BRIDGE


RIVER: Mill Brook
REACH: Main               RS: 140

INPUT
Description: Mystic St. Bridge
Distance from Upstream XS =      .5
Deck/Roadway Width        =      62
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      12
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    -107    17.5       0     -50   16.85       0      -9    16.7       0
      -9   19.65       0    -8.6   19.65       0    -8.6   19.65    12.5
       0   19.65    12.5     9.6   19.65    12.5     9.6    16.7       0
      94    17.1       0     230    17.9             390    19.4

Upstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    -186       20     -141       19      -80    17.18      -50     16.8      -22       16
   -15.7       15      -13    12.76    -8.61    12.76     -8.6        9    -4.85      8.9
```

```
     -1     9.6       0     9.2       1     9.2     4.3       9    13.6     8.8
   13.61    12.5   13.62   16.48    65.6    16.5     230   17.55     390      19

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
    -186     .06   -8.61     .02    -8.6    .045    13.6     .02   13.61     .06

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -8.61   13.61             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    -186   -8.61    16.7       F
     9.6     390    16.7       F

Downstream  Deck/Roadway Coordinates
    num=      12
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    -107    17.5       0     -50   16.85       0      -9    16.7       0
      -9   19.65       0    -8.6   19.65       0    -8.6   19.65    12.5
       0   19.65    12.5     9.6   19.65    12.5     9.6    16.7       0
      94    17.1       0     230    17.9             390    19.4

Downstream Bridge Cross Section Data
Station Elevation Data    num=      19
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    -214      20    -173      19  -114.5      18   -64.5      17     -35      16
   -8.61    15.7    -8.6     7.8    -3.8     8.2      -1     8.3       0       8
       1     8.7     5.9     8.7     8.8     8.9    17.1      13    23.5   16.25
    41.5    16.7    91.5      17     204   17.16     340      19

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
    -214     .06   -8.61     .02    -8.6     .04    17.1     .07    41.5     .05

Bank Sta: Left   Right    Coeff Contr.   Expan.
         -8.61    17.1             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    -214    -8.6    16.7       F
     9.6     340    16.7       F

Upstream Embankment side slope            =       0 horiz. to 1.0 vertical
Downstream Embankment side slope          =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins       =    16.7
Energy head used in spillway design       =
Spillway height used in design            =
Weir crest shape                          = Broad Crested

Number of Piers =  1

Pier Data
Pier Station     Upstream=       0    Downstream=       0
Upstream     num=       2
    Width   Elev    Width   Elev
       2       7       2    12.8
Downstream     num=       2
    Width   Elev    Width   Elev
       2       7       2    12.8

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
```

Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord = 12.5

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 115

INPUT
Description: Downstream face of Mystic Street Bridge
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-214	20	-173	19	-114.5	18	-64.5	17	-35	16
-8.61	15.7	-8.6	7.8	-3.8	8.2	-1	8.3	0	8
1	8.7	5.9	8.7	8.8	8.9	17.1	13	23.5	16.25
41.5	16.7	91.5	17	204	17.16	340	19		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-214	.06	-8.61	.02	-8.6	.04	17.1	.07	41.5	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-8.61	17.1	45	40	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-214	-8.6	16.7	F
9.6	340	16.7	F

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 75

INPUT
Description: 40 Downstream of Mystic St. Bridge
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-5.31	20	-5.3	11	-5.3	8.97	0	8.53	6.7	8.76
8.8	11	13	15.27	30	16	30	20		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-5.31	.02	-5.3	.04	8.8	.07	13	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-5.3	8.8	75	75	74	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 0

INPUT
Description: Downstream End of Model (FEMA Cross-Section E)
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-6.1	20	-6	10	-6	8.33	0	8.44	7	8.71
8.6	10	13.3	13.78	21.4	14	21.4	22.5		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-6.1	.02	-6	.04	8.6	.07	13.3	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-6	8.6	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Mill Brook

Reach	River Sta.	n1	n2	n3	n4	n5
Main	458	.06	.045	.07		
Main	384	.06	.045	.07		
Main	309	.06	.045	.06		
Main	244	.06	.045	.02	.06	
Main	179	.06	.02	.045	.02	.06
Main	140	Bridge				
Main	115	.06	.02	.04	.07	.05
Main	75	.02	.04	.07	.05	
Main	0	.02	.04	.07	.05	

SUMMARY OF REACH LENGTHS

River: Mill Brook

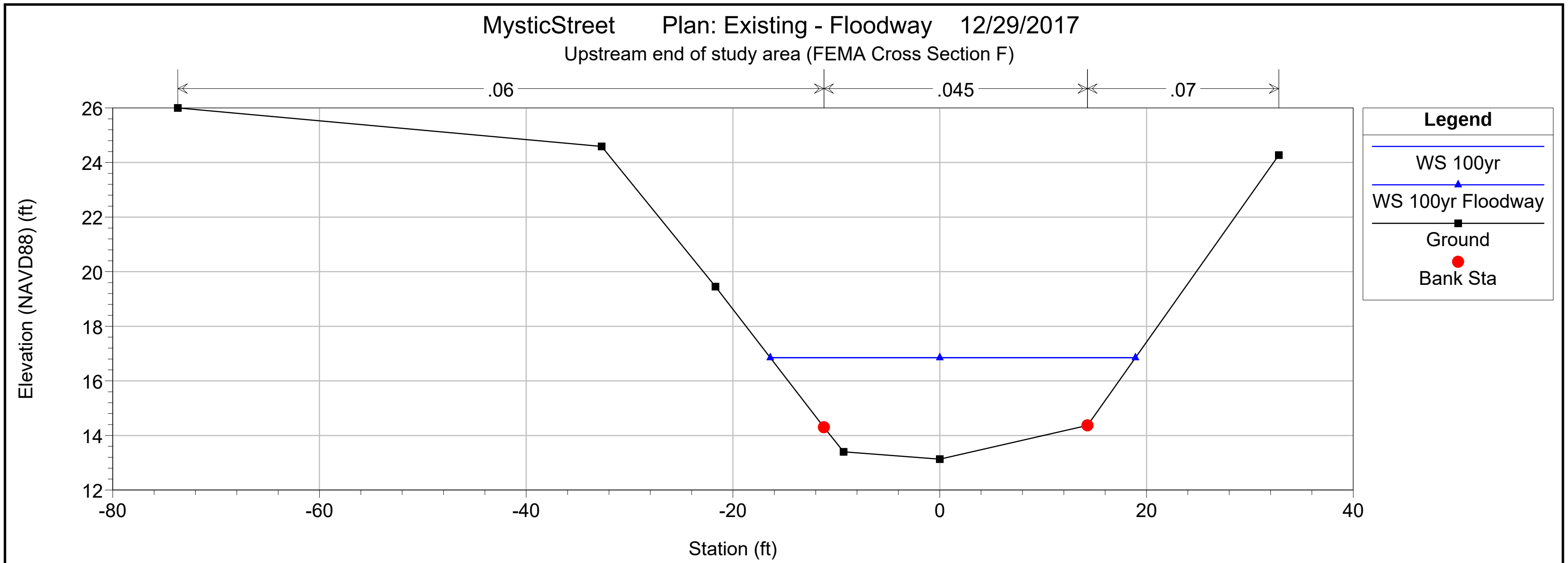
Reach	River Sta.	Left	Channel	Right
Main	458	77	74	70
Main	384	67	74	78
Main	309	66	65	65
Main	244	66	66	66
Main	179	63	63	66
Main	140	Bridge		
Main	115	45	40	30
Main	75	75	75	74
Main	0	0	0	0

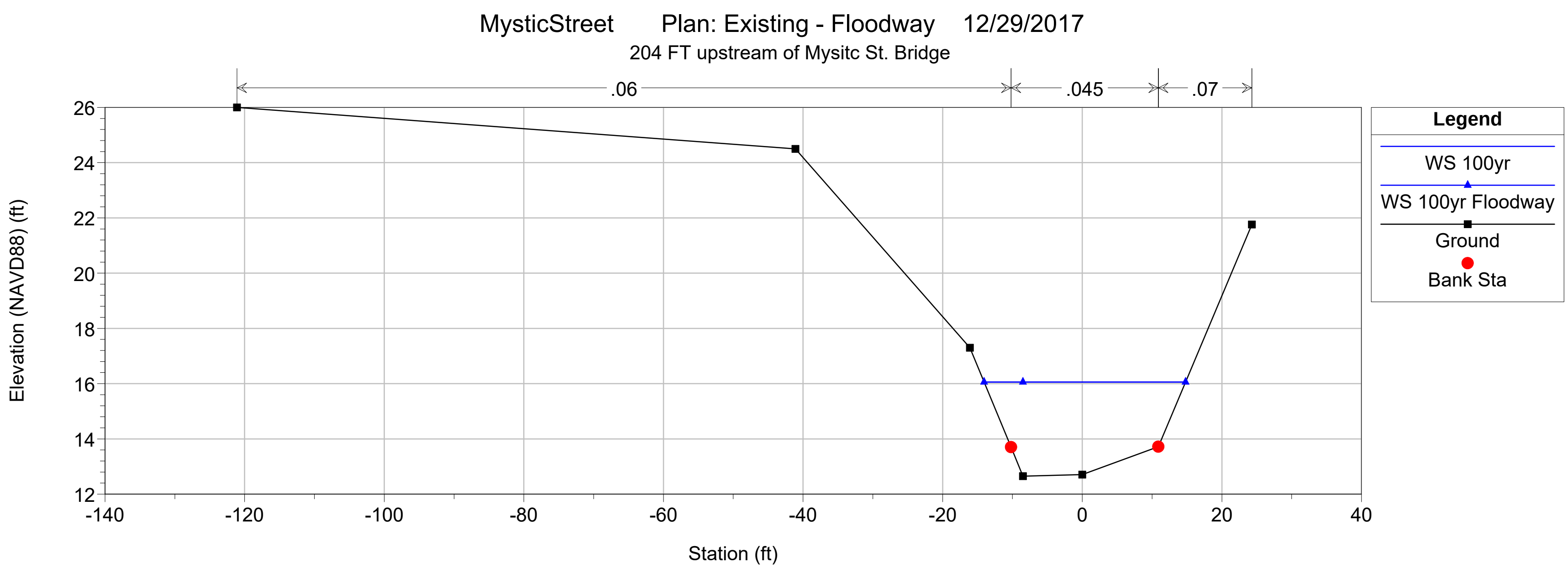
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Mill Brook

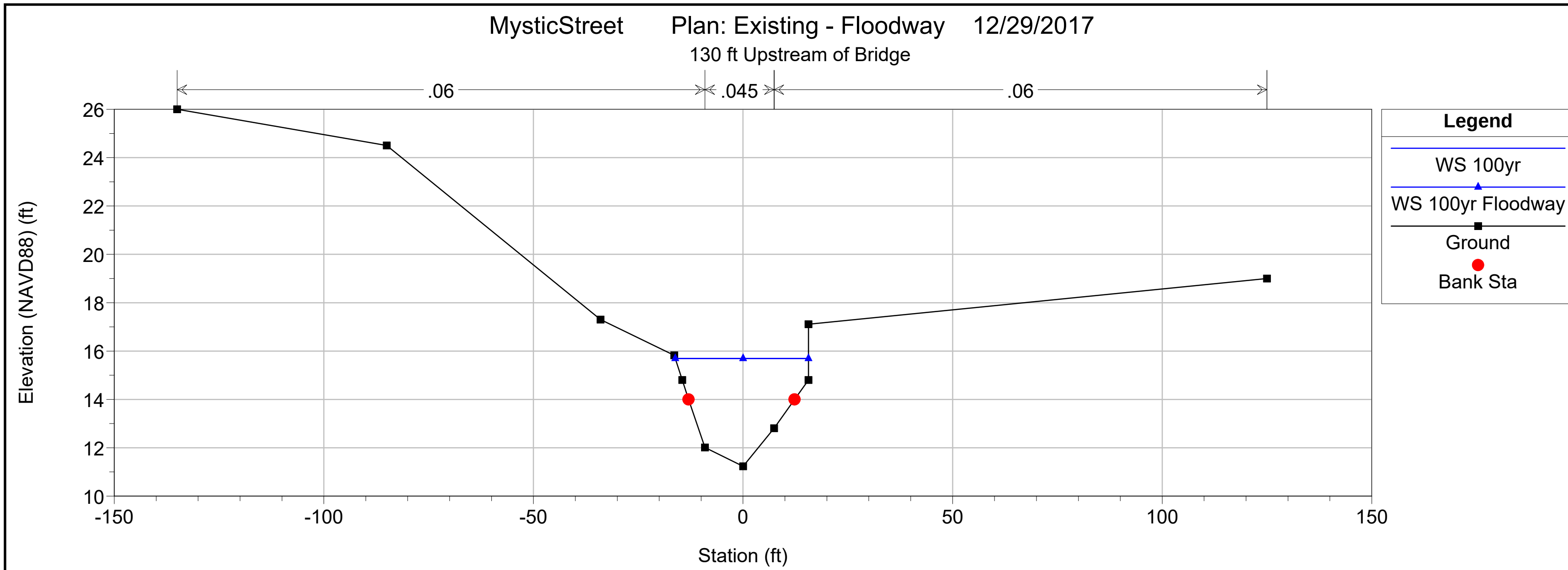
Reach	River Sta.		Contr.	Expan.
Main	458		.1	.3
Main	384		.1	.3
Main	309		.1	.3
Main	244		.1	.3
Main	179		.3	.5
Main	140	Bridge		
Main	115		.3	.5
Main	75		.1	.3
Main	0		.1	.3

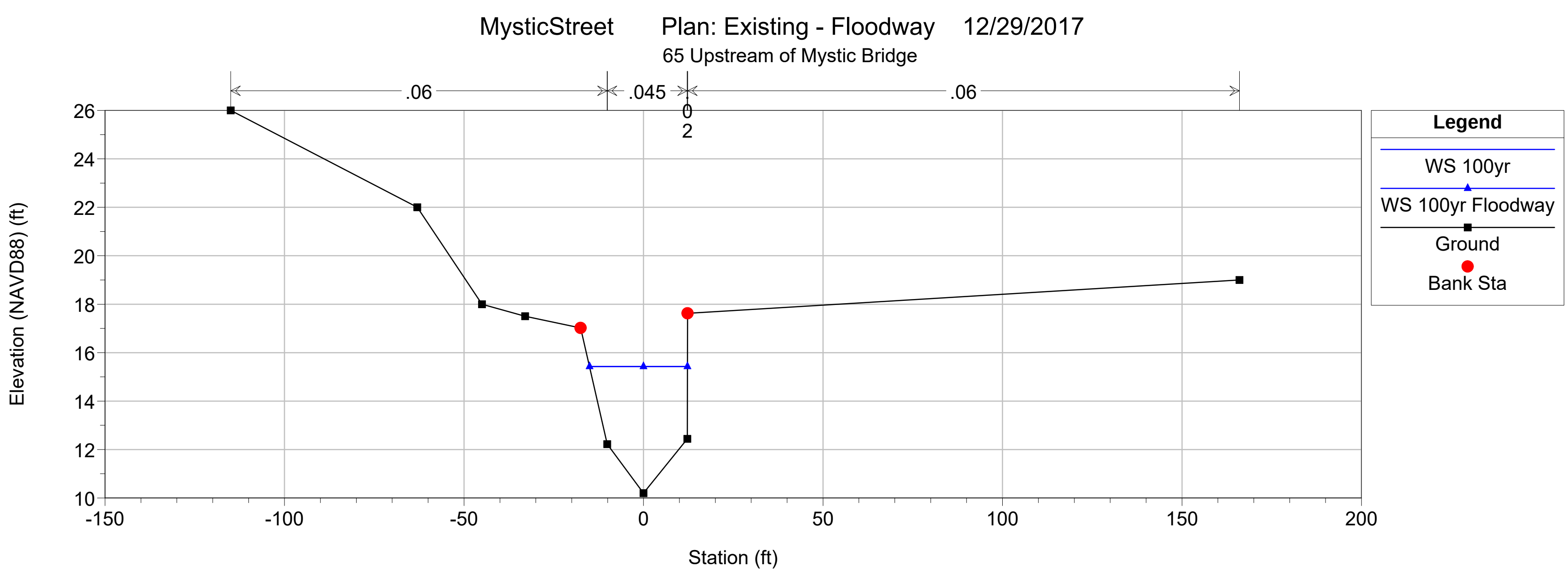
HEC-RAS Plan: Exist-Fldway River: Mill Brook Reach: Main

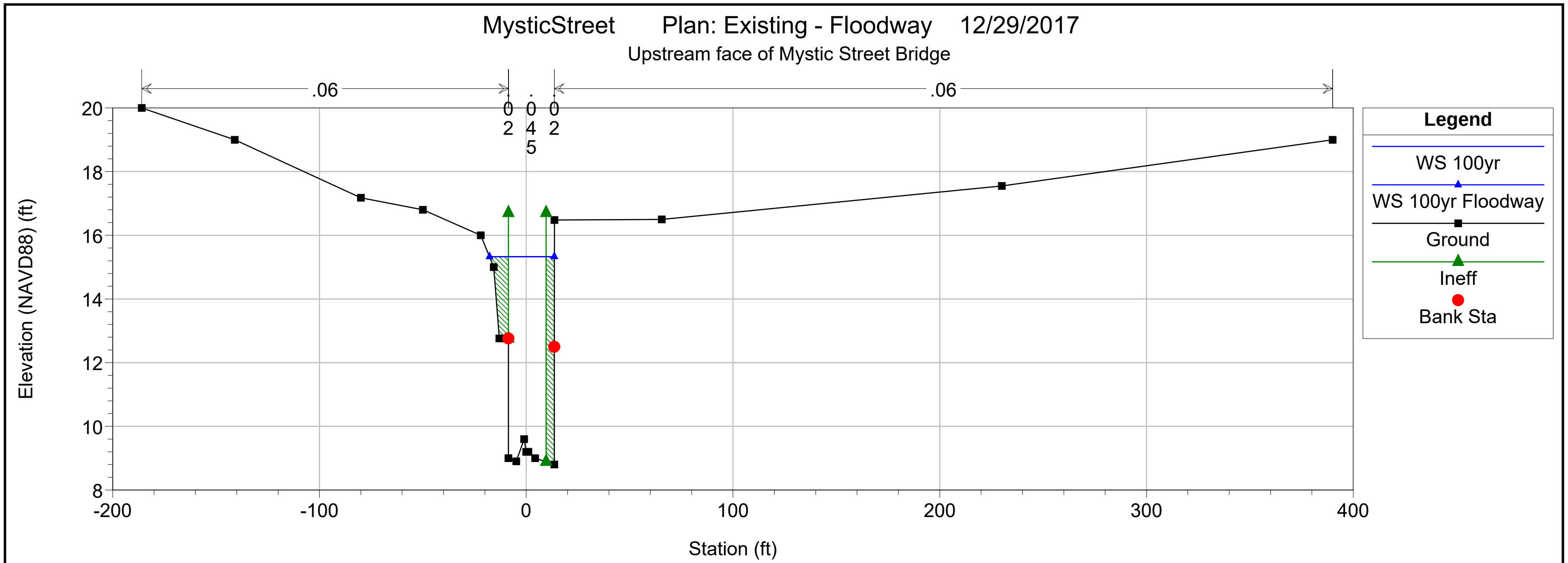
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	0	100yr	450.00	8.33	11.67	11.67	13.18	0.018836	9.88	46.91	16.70	0.99
Main	0	100yr Floodway	450.00	8.33	11.67	11.67	13.18	0.018836	9.88	46.91	16.70	0.99
Main	75	100yr	450.00	8.53	13.24	12.03	14.05	0.006866	7.23	64.17	16.31	0.61
Main	75	100yr Floodway	450.00	8.53	13.24	12.03	14.05	0.006869	7.24	64.16	16.30	0.61
Main	115	100yr	450.00	7.80	14.01	11.10	14.31	0.001482	4.43	101.47	27.69	0.33
Main	115	100yr Floodway	450.00	7.80	14.01	11.10	14.31	0.001482	4.44	101.46	25.61	0.33
Main	140		Bridge									
Main	179	100yr	450.00	8.80	15.33	11.74	15.58	0.001360	3.95	113.83	31.39	0.28
Main	179	100yr Floodway	450.00	8.80	15.33	11.74	15.58	0.001361	3.95	113.82	31.39	0.28
Main	244	100yr	450.00	10.20	15.43		15.74	0.004084	4.47	100.68	27.30	0.41
Main	244	100yr Floodway	450.00	10.20	15.43		15.74	0.004085	4.47	100.67	27.30	0.41
Main	309	100yr	450.00	11.23	15.69		16.08	0.006173	5.09	92.80	31.76	0.49
Main	309	100yr Floodway	450.00	11.23	15.69		16.08	0.006174	5.09	92.80	31.76	0.49
Main	384	100yr	450.00	12.65	16.06		16.72	0.009313	6.65	73.75	28.87	0.67
Main	384	100yr Floodway	450.00	12.65	16.06		16.72	0.009314	6.65	73.75	28.86	0.67
Main	458	100yr	450.00	13.13	16.85		17.24	0.005056	5.14	95.71	35.33	0.50
Main	458	100yr Floodway	450.00	13.13	16.85		17.24	0.005056	5.14	95.71	35.33	0.50


MysticStreet Plan: Existing - Floodway 12/29/2017
Upstream end of study area (FEMA Cross Section F)
.06
.045
.07
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta

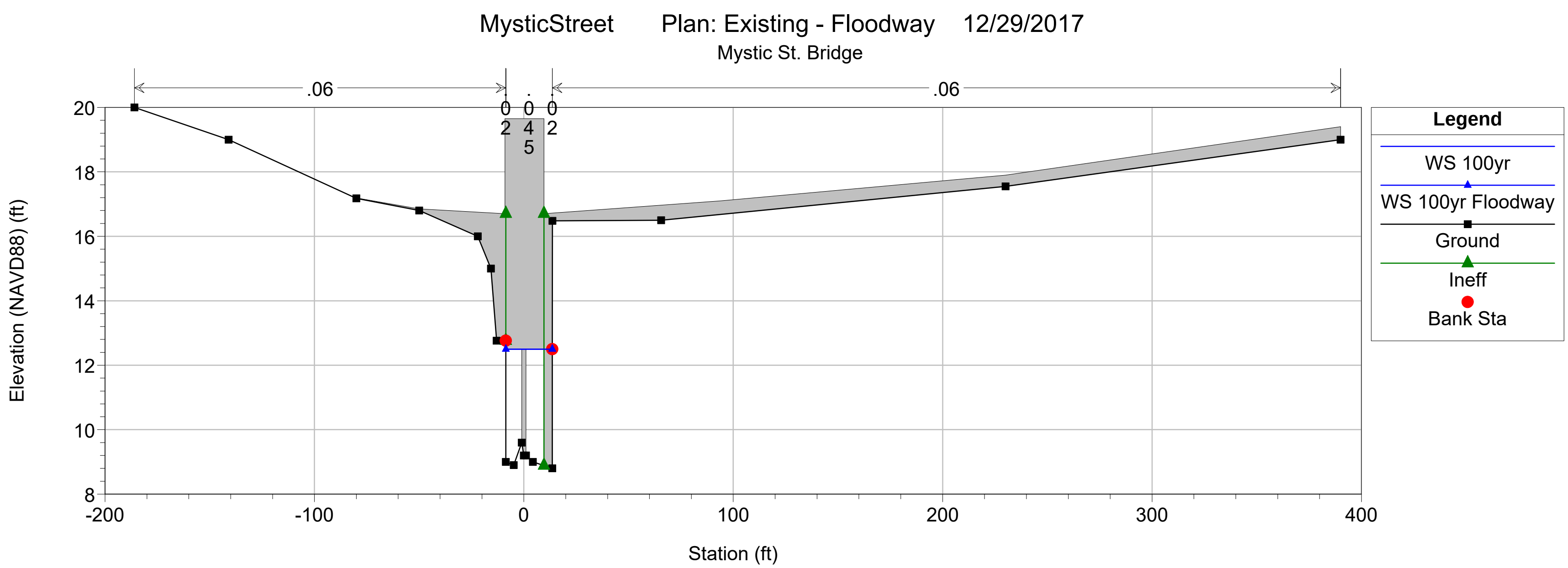

MysticStreet Plan: Existing - Floodway 12/29/2017
204 FT upstream of Mysitc St. Bridge
.06
.045
.07
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta


MysticStreet Plan: Existing - Floodway 12/29/2017
130 ft Upstream of Bridge
.06
.045
.06
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta
Elevation (NAVD88) (ft)
26
24
22
20
18
16
14
12
10
-150
-100
-50
0
50
100
150
Station (ft)

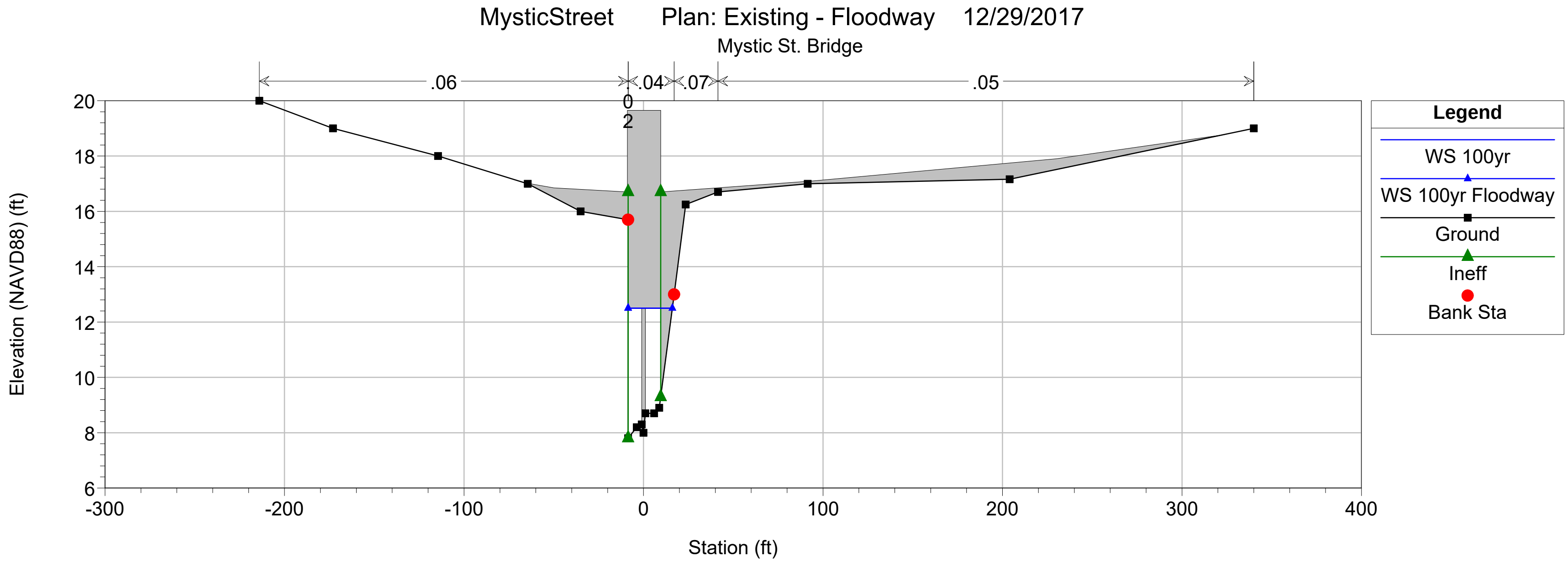

MysticStreet Plan: Existing - Floodway 12/29/2017
65 Upstream of Mystic Bridge
.06
.045
.06
0
2
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta
Elevation (NAVD88) (ft)
26
24
22
20
18
16
14
12
10
-150
-100
-50
0
50
100
150
200
Station (ft)

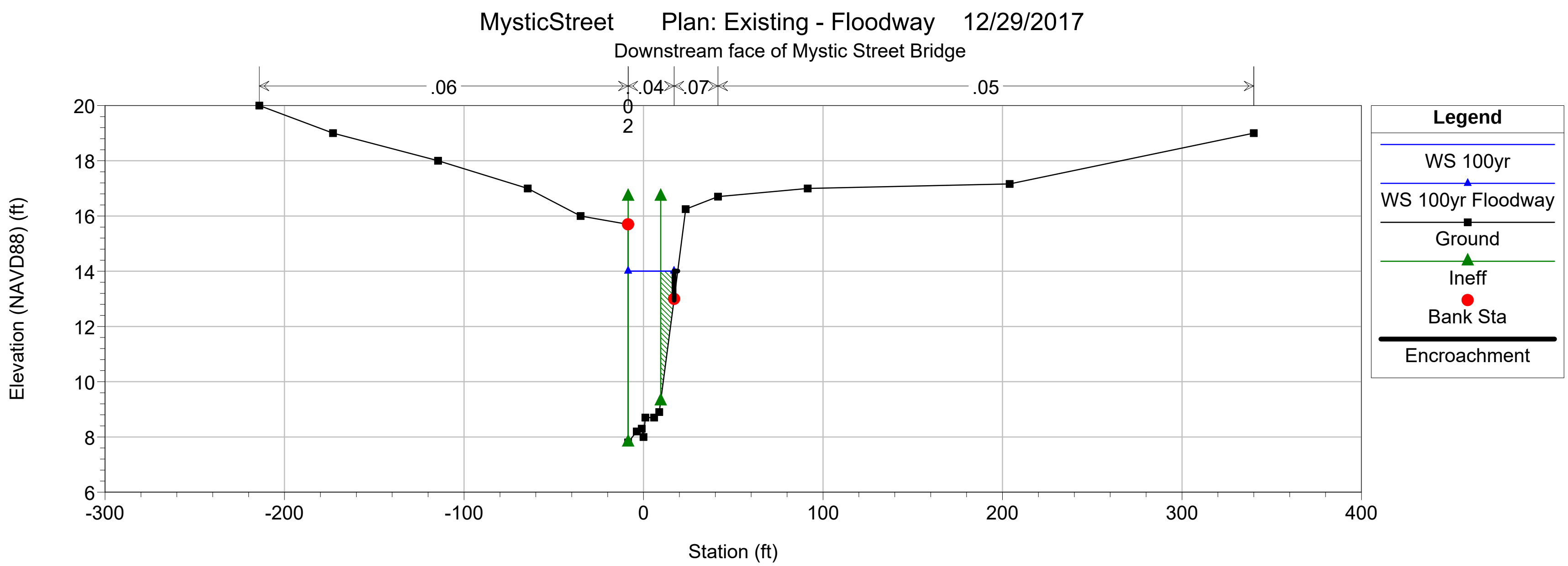


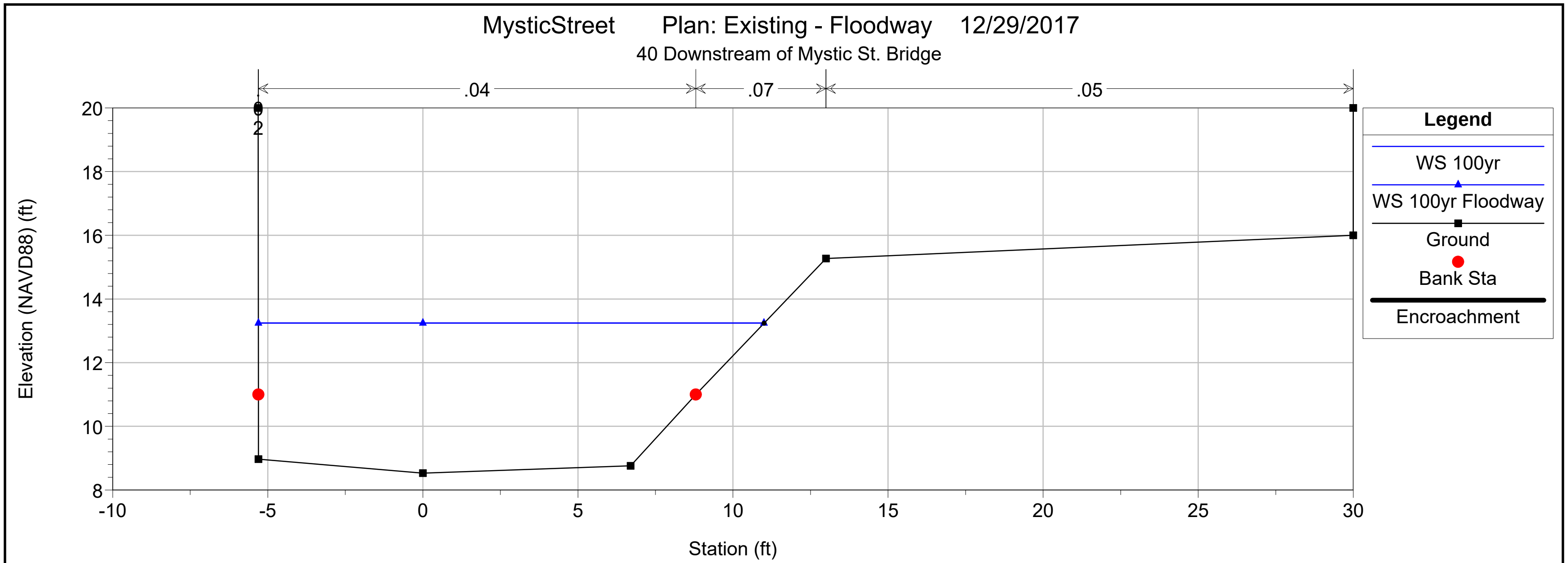
MysticStreet Plan: Existing - Floodway 12/29/2017
Upstream face of Mystic Street Bridge
.06
.06
.
0 2
0 4 5
0 2
Legend
WS 100yr
WS 100yr Floodway
Ground
Ineff
Bank Sta
Elevation (NAVD88) (ft)
20
18
16
14
12
10
8
-200
-100
0
100
200
300
400
Station (ft)

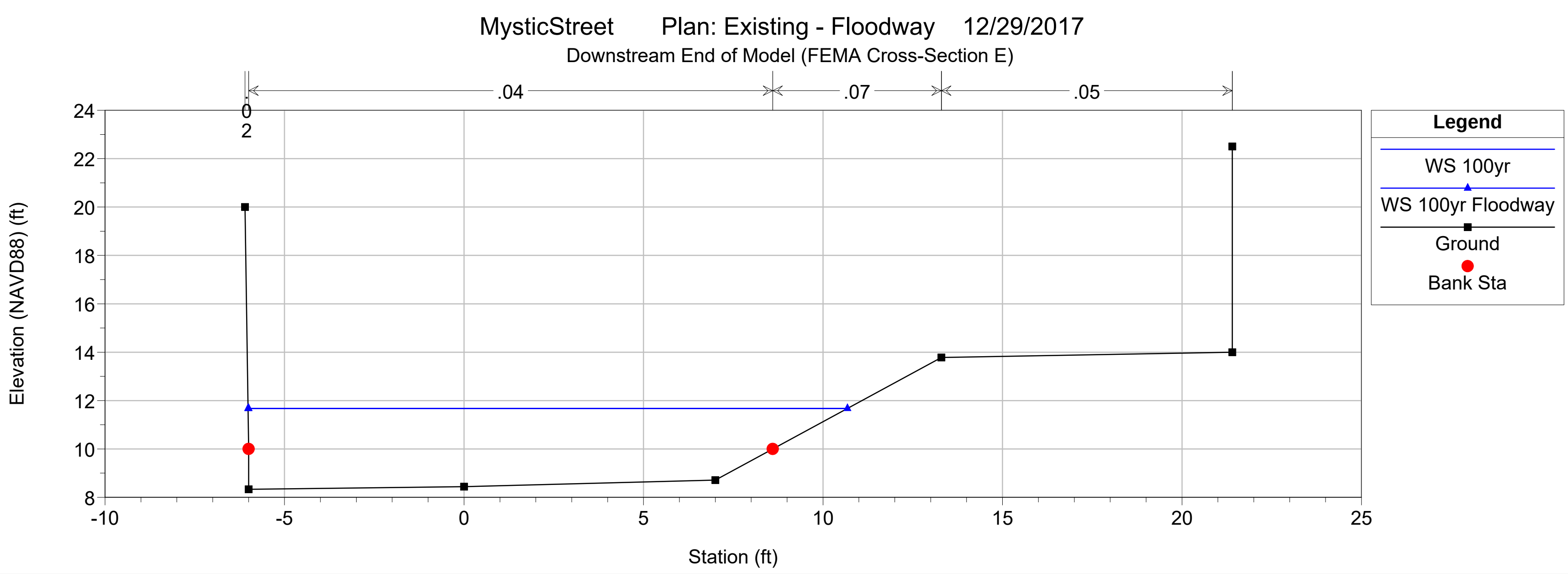


MysticStreet Plan: Existing - Floodway 12/29/2017
Mystic St. Bridge
.06
.06
.
0 2
0 4 5
0 2
Legend
WS 100yr
WS 100yr Floodway
Ground
Ineff
Bank Sta
Elevation (NAVD88) (ft)
20
18
16
14
12
10
8
-200
-100
0
100
200
300
400
Station (ft)


MysticStreet Plan: Existing - Floodway 12/29/2017
Mystic St. Bridge
.06
.04
.07
.05
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
WS 100yr Floodway
Ground
Ineff
Bank Sta


MysticStreet Plan: Existing - Floodway 12/29/2017
Downstream face of Mystic Street Bridge
.06
.04
.07
.05
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
WS 100yr Floodway
Ground
Ineff
Bank Sta
Encroachment


MysticStreet Plan: Existing - Floodway 12/29/2017
40 Downstream of Mystic St. Bridge
.04
.07
.05
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta
Encroachment


MysticStreet Plan: Existing - Floodway 12/29/2017
Downstream End of Model (FEMA Cross-Section E)
.04
.07
.05
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta

APPENDIX E

Proposed Conditions

Proposed Conditions -Design Flows

```
                    HEC-RAS Version 4.1.0 Jan 2010
                    U.S. Army Corps of Engineers
                    Hydrologic Engineering Center
                          609 Second Street
                          Davis, California

X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: MysticStreet
Project File : MysticStreet.prj
Run Date and Time: 12/29/2017 1:16:50 PM

Project in English units

Project Description:
Project: Mystic Street Bridge Replacement in Arlington, MA
Done by: LEC and
RSV
Datum: NAVD88

PLAN DATA

Plan Title: Proposed - Floodway
Plan File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.p02

Geometry Title: Proposed
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.g03

Flow Title   : FEMA Floodway Flows
Flow File   : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.f02

Plan Description:
Proposed conditions with FEMA Flows

```
Plan Summary Information:
Number of:  Cross Sections =    8    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    1    Lateral Structures =    0

Computational Information
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
```

Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = Mill Brook Reach = Main

RS	Profile	Method	Value1	Value2
458	100yr Floodway	1	-17	22
384	100yr Floodway	1	-36	24
309	100yr Floodway	1	-38	48
244	100yr Floodway	1	-25	35
179	100yr Floodway	1	-45	25
115	100yr Floodway	1	-25	17
75	100yr Floodway	1	-25	11
0	100yr Floodway	1	-45	18

FLOW DATA

Flow Title: FEMA Floodway Flows
Flow File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.f02

Flow Data (cfs)

River	Reach	RS	100yr	100yr Floodway
Mill Brook	Main	458	450	450

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Mill Brook	Main	100yr	Normal S = 0.063	Known WS = 10.8
Mill Brook	Main	100yr Floodway	Normal S = 0.063	Known WS = 10.9

GEOMETRY DATA

Geometry Title: Proposed
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 11.06.17\MysticStreet.g03

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 458

```
INPUT
Description: Upstream end of study area (FEMA Cross Section F)
Station Elevation Data    num=       8
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
   -73.7       26    -32.7    24.59    -21.7    19.45    -11.2     14.3     -9.3     13.4
       0    13.13     14.3    14.37     32.8    24.27

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
   -73.7      .06    -11.2      .04     14.3      .07

Bank Sta: Left    Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
          -11.2    14.3                 77      74      70              .1       .3

CROSS SECTION


RIVER: Mill Brook
REACH: Main               RS: 384

INPUT
Description: 204 FT upstream of Mysitc St. Bridge
Station Elevation Data    num=       8
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
  -121.1       26    -41.1     24.5    -16.1     17.3    -10.2     13.7     -8.5    12.65
       0    12.71     10.9    13.72     24.3    21.76

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
  -121.1      .06    -10.2     .045     10.9      .07

Bank Sta: Left    Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
          -10.2    10.9                 67      74      78              .1       .3

CROSS SECTION


RIVER: Mill Brook
REACH: Main               RS: 309

INPUT
Description: 130 ft Upstream of Bridge
Station Elevation Data    num=      13
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
    -135       26      -85     24.5      -34     17.3    -16.4    15.82    -14.5     14.8
     -13       14     -9.1    12.01        0    11.23      7.4    12.81     12.3       14
    15.6     14.8    15.61    17.11      125       19

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
    -135      .06     -9.1     .045      7.4      .06

Bank Sta: Left    Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
            -13    12.3                 66      65      65              .1       .3

CROSS SECTION


RIVER: Mill Brook
REACH: Main               RS: 244

INPUT
```

Description: 65 Upstream of Mystic Bridge
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-115	26	-63	22	-45	18	-33	17.5	-17.5	17.02
-10.1	12.22	0	10.2	12.2	12.44	12.3	17.62	166	19

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-115	.06	-10.1	.045	12.2	.02	12.3	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-17.5	12.3	66	66	66	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 179

INPUT
Description: Upstream face of Mystic Street Bridge
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-186	20	-141	19	-80	17.18	-50	16.8	-22	16
-15.7	15	-13.91	12.89	-13.9	9.89	-12.9	9.89	-10.24	8.63
-10.24	8.6	7.96	8.6	7.96	8.63	10.62	9.89	14.45	9.89
14.45	12.89	14.46	16.48	15	16.48	65.6	16.5	230	17.55
390	19								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-186	.06	-13.91	.02	-13.9	.045	14.45	.02	14.46	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-13.91	14.45	63	63	66	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-186	-13.91	16.92	F
14.45	390	16.92	F

BRIDGE

RIVER: Mill Brook
REACH: Main RS: 140

INPUT
Description: Mystic St. Bridge
Distance from Upstream XS = .5
Deck/Roadway Width = 62
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 16

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-107	17.5	0	-50	17	0	-13.9	16.93	0
-13.9	16.93	12.89	-9	16.92	12.89	-9	19.65	12.89
-8.6	19.65	12.89	-8.6	19.65	12.89	0	19.65	12.89
9.6	19.65	12.89	9.6	16.92	12.89	14.9	16.93	12.89
14.9	16.93	0	94	17.1	0	230	17.9	
390	19.4							

Upstream Bridge Cross Section Data
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-186	20	-141	19	-80	17.18	-50	16.8	-22	16
-15.7	15	-13.91	12.89	-13.9	9.89	-12.9	9.89	-10.24	8.63
-10.24	8.6	7.96	8.6	7.96	8.63	10.62	9.89	14.45	9.89
14.45	12.89	14.46	16.48	15	16.48	65.6	16.5	230	17.55
390	19								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-186	.06	-13.91	.02	-13.9	.045	14.45	.02	14.46	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
-13.91	14.45	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-186	-13.91	16.92	F
14.45	390	16.92	F

Downstream Deck/Roadway Coordinates
num= 16

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-107	17.5	0	-50	17	0	-13.9	16.93	0
-13.9	16.93	12.89	-9	16.92	12.89	-9	19.65	12.89
-8.6	19.65	12.89	-8.6	19.65	12.89	0	19.65	12.89
9.6	19.65	12.89	9.6	16.92	12.89	14.9	16.93	12.89
14.9	16.93	0	94	17.1	0	230	17.9	
390	19.4							

Downstream Bridge Cross Section Data
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-214	20	-173	19	-114.5	18	-64.5	17	-35	16
-14	14	-13.9	12.89	-13.9	9.89	-12.9	9.89	-10.24	8.63
-10.24	8.5	7.96	8.5	7.96	8.63	10.62	9.89	14.45	9.89
14.45	12.89	14.46	15	17.1	15	23.5	16.25	41.5	16.7
91.5	17	204	17.16	340	19				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-214	.06	-14	.02	-13.9	.045	14.45	.02	14.46	.07
41.5	.05								

Bank Sta: Left	Right	Coeff Contr.	Expan.
-13.9	14.46	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-214	-13.9	16.92	F
14.45	340	16.92	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins = 16.92
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 115

INPUT
Description: Downstream face of Mystic Street Bridge
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-214	20	-173	19	-114.5	18	-64.5	17	-35	16
-14	14	-13.9	12.89	-13.9	9.89	-12.9	9.89	-10.24	8.63
-10.24	8.5	7.96	8.5	7.96	8.63	10.62	9.89	14.45	9.89
14.45	12.89	14.46	15	17.1	15	23.5	16.25	41.5	16.7
91.5	17	204	17.16	340	19				

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-214	.06	-14	.02	-13.9	.045	14.45	.02	14.46	.07
41.5	.05								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-13.9	14.46	45	40	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-214	-13.9	16.92	F
14.45	340	16.92	F

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 75

INPUT
Description: 40 Downstream of Mystic St. Bridge
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-5.31	20	-5.3	11	-5.3	8.97	0	8.53	6.7	8.76
8.8	11	13	15.27	30	16	30	20		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-5.31	.02	-5.3	.04	8.8	.07	13	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-5.3	8.8	75	75	74	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 0

INPUT
Description: Downstream End of Model (FEMA Cross-Section E)
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-6.1	20	-6	10	-6	8.33	0	8.44	7	8.71
8.6	10	13.3	13.78	21.4	14	21.4	22.5		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-6.1	.02	-6	.04	8.6	.07	13.3	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-6	8.6	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Mill Brook

Reach	River Sta.	n1	n2	n3	n4	n5	n6
Main	458	.06	.04	.07			
Main	384	.06	.045	.07			
Main	309	.06	.045	.06			
Main	244	.06	.045	.02	.06		
Main	179	.06	.02	.045	.02	.06	
Main	140	Bridge					
Main	115	.06	.02	.045	.02	.07	.05
Main	75	.02	.04	.07	.05		
Main	0	.02	.04	.07	.05		

SUMMARY OF REACH LENGTHS

River: Mill Brook

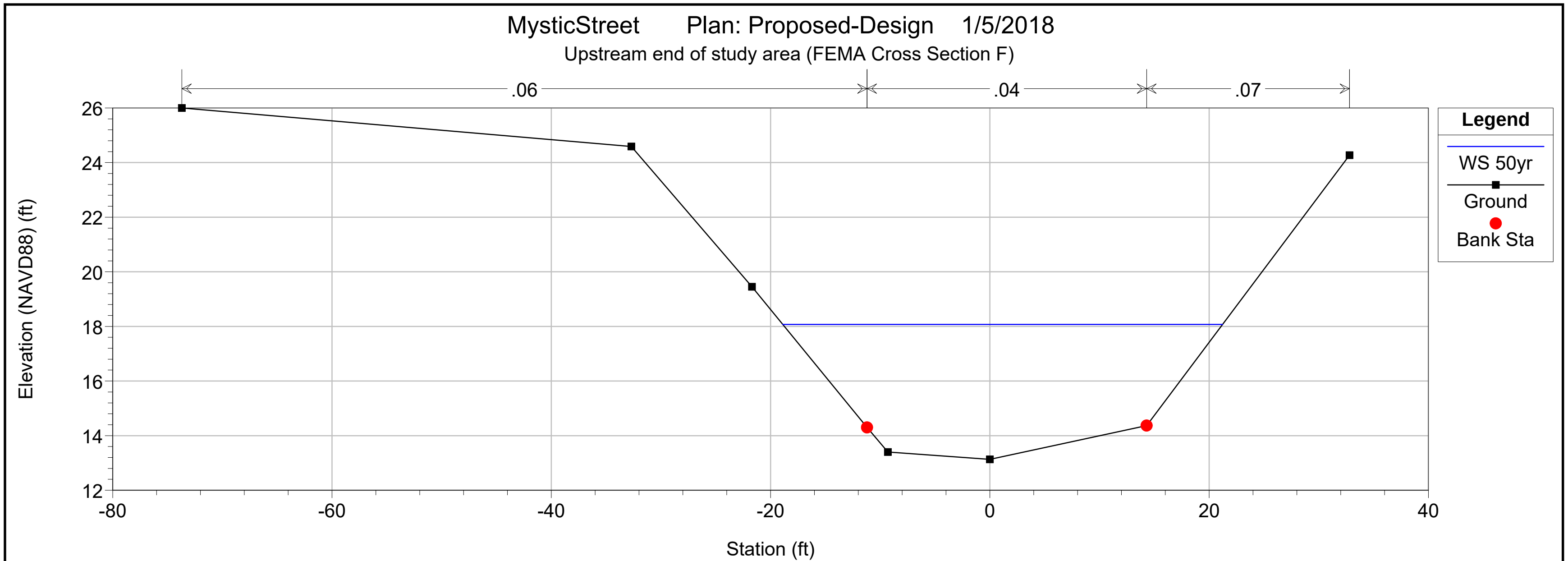
Reach	River Sta.	Left	Channel	Right
Main	458	77	74	70
Main	384	67	74	78
Main	309	66	65	65
Main	244	66	66	66
Main	179	63	63	66
Main	140	Bridge		
Main	115	45	40	30
Main	75	75	75	74
Main	0	0	0	0

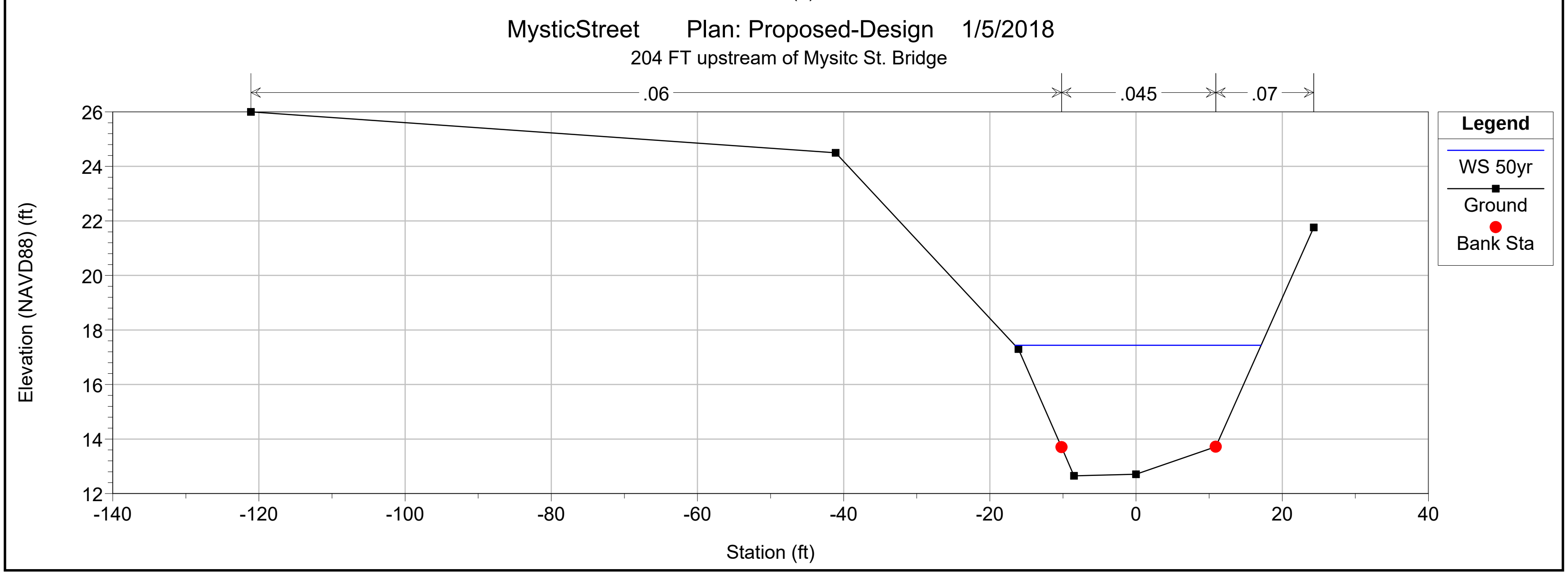
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Mill Brook

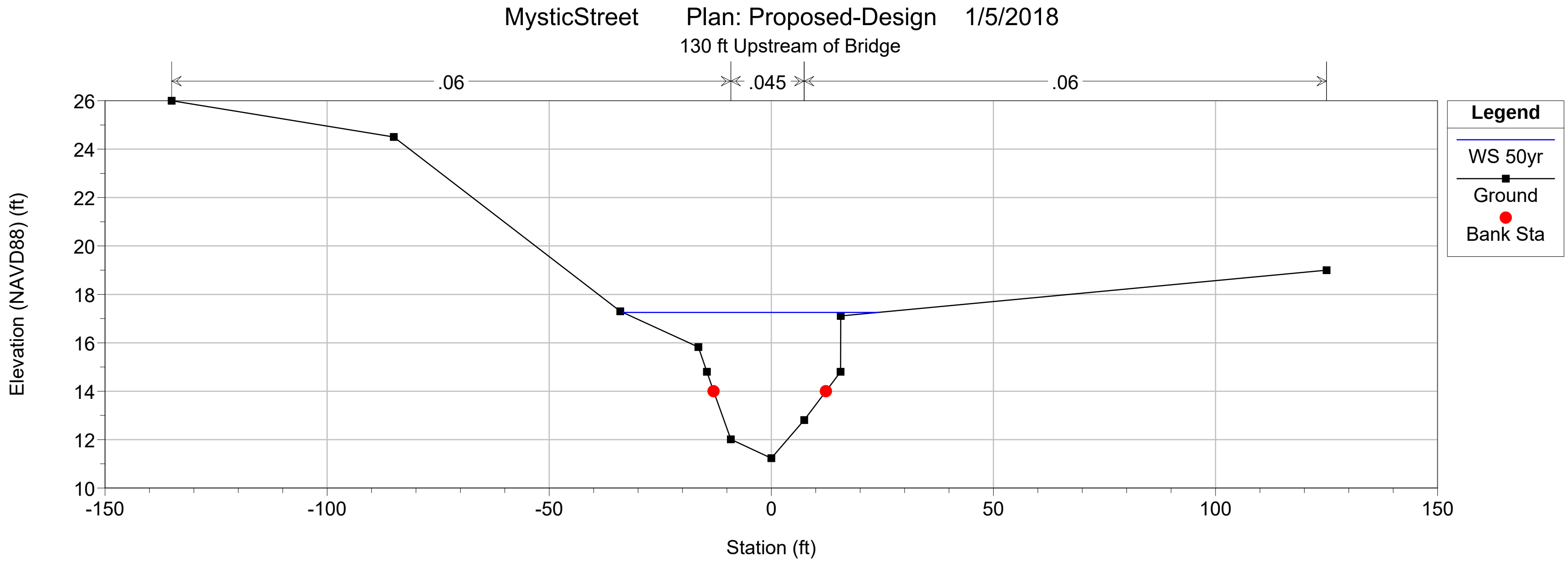
Reach	River Sta.		Contr.	Expan.
Main	458		.1	.3
Main	384		.1	.3
Main	309		.1	.3
Main	244		.1	.3
Main	179		.3	.5
Main	140	Bridge		
Main	115		.3	.5
Main	75		.1	.3
Main	0		.1	.3

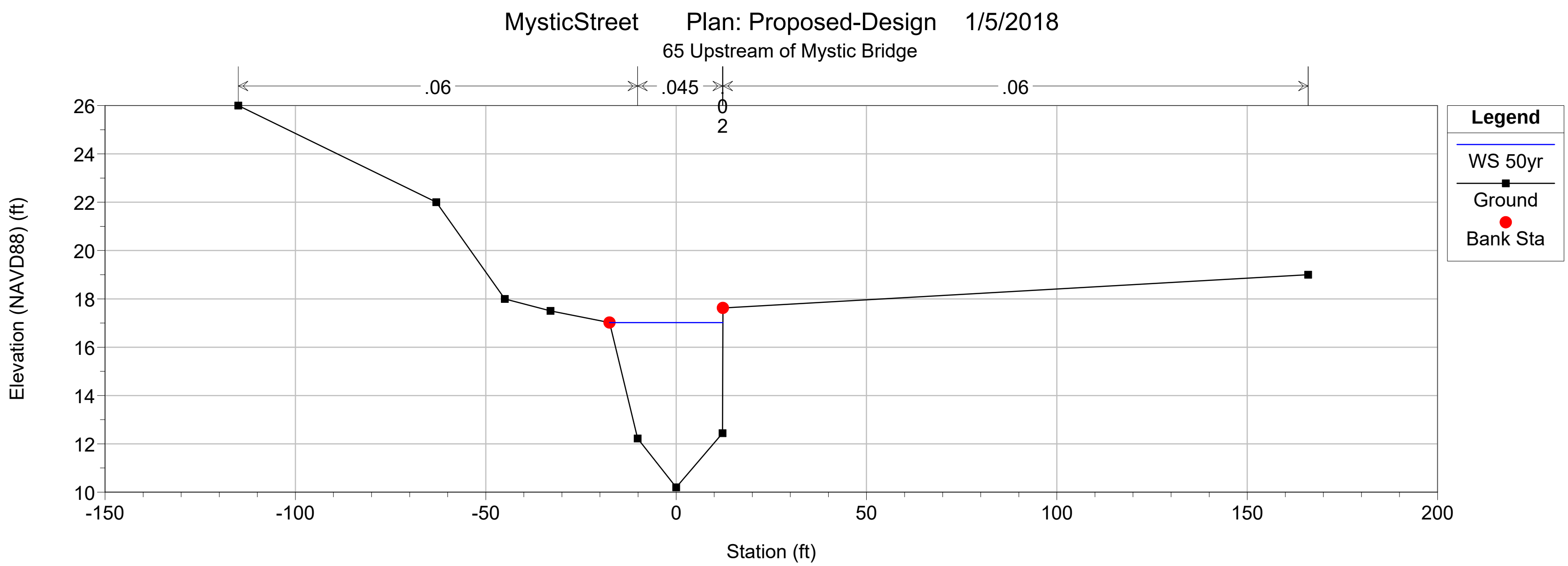
HEC-RAS Plan: Prop-Des River: Mill Brook Reach: Main

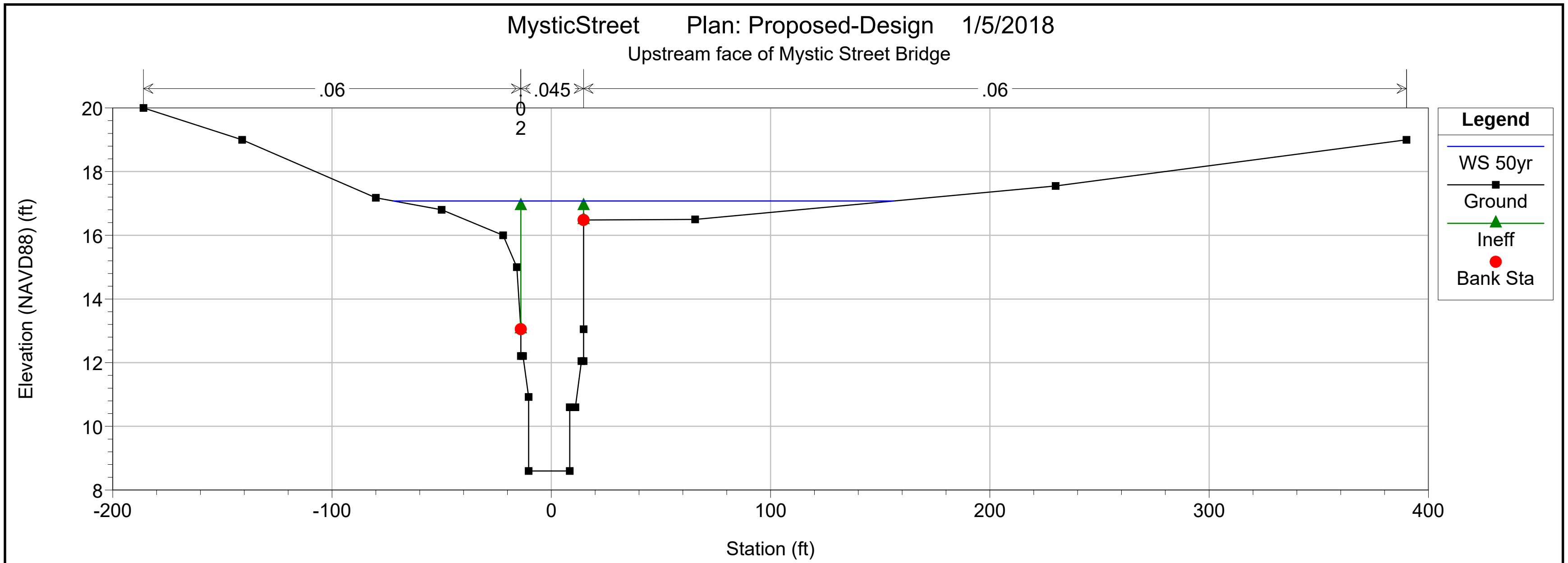
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	0	2yr	201.00	8.33	10.38	10.38	11.29	0.023142	7.64	26.39	15.08	1.00
Main	0	5yr	338.00	8.33	11.14	11.14	12.40	0.020235	9.02	38.13	16.03	0.99
Main	0	10yr	449.00	8.33	11.67	11.67	13.17	0.018853	9.88	46.83	16.69	0.99
Main	0	25yr	612.00	8.33	12.37	12.37	14.19	0.017419	10.89	58.89	17.58	0.99
Main	0	50yr	750.00	8.33	12.93	12.93	14.97	0.016368	11.56	68.88	18.27	0.98
Main	0	100yr	904.00	8.33	13.45	13.45	15.77	0.016138	12.38	78.53	18.92	0.99
Main	0	200yr	1075.00	8.33	14.34	14.34	16.55	0.012526	12.20	99.37	27.44	0.90
Main	0	500yr	1207.00	8.33	14.77	14.77	17.07	0.012053	12.55	111.03	27.45	0.89
Main	75	2yr	201.00	8.53	11.73	10.69	12.11	0.005745	4.98	40.57	14.82	0.52
Main	75	5yr	338.00	8.53	12.63		13.25	0.006464	6.35	54.33	15.70	0.58
Main	75	10yr	449.00	8.53	13.24	12.02	14.04	0.006865	7.23	64.08	16.30	0.61
Main	75	25yr	612.00	8.53	14.01	12.76	15.07	0.007340	8.33	76.94	17.06	0.65
Main	75	50yr	750.00	8.53	14.58	13.34	15.85	0.007701	9.15	86.79	17.62	0.67
Main	75	100yr	904.00	8.53	15.18	13.92	16.67	0.007938	9.93	97.54	18.21	0.70
Main	75	200yr	1075.00	8.53	15.51	14.54	17.40	0.009376	11.17	104.31	23.90	0.76
Main	75	500yr	1207.00	8.53	15.71	15.00	17.93	0.010603	12.12	109.64	28.63	0.82
Main	115	2yr	201.00	8.60	12.22	10.12	12.33	0.002142	2.63	76.39	28.66	0.28
Main	115	5yr	338.00	8.60	13.37	10.84	13.52	0.001910	3.09	109.46	28.70	0.28
Main	115	10yr	449.00	8.60	14.18	11.28	14.36	0.001823	3.39	132.55	31.07	0.28
Main	115	25yr	612.00	8.60	15.23	11.86	15.45	0.001713	3.76	162.63	45.18	0.28
Main	115	50yr	750.00	8.60	16.03	12.32	16.29	0.001655	4.04	185.63	58.32	0.28
Main	115	100yr	904.00	8.60	16.87	12.70	17.16	0.001603	4.31	209.64	130.43	0.28
Main	115	200yr	1075.00	8.60	17.86	13.08	18.00	0.000858	3.42	560.89	363.34	0.21
Main	115	500yr	1207.00	8.60	18.54	13.36	18.62	0.000548	2.88	836.29	451.74	0.17
Main	140		Bridge									
Main	179	2yr	201.00	8.60	12.36	10.13	12.45	0.001824	2.50	80.33	28.66	0.26
Main	179	5yr	338.00	8.60	13.51	10.84	13.65	0.001727	2.98	113.31	29.09	0.26
Main	179	10yr	449.00	8.60	14.51	11.28	14.67	0.001491	3.16	141.98	30.01	0.25
Main	179	25yr	612.00	8.60	15.96	11.86	16.13	0.001239	3.33	183.59	36.50	0.23
Main	179	50yr	750.00	8.60	17.08	12.32	17.24	0.000979	3.27	309.29	228.19	0.21
Main	179	100yr	904.00	8.60	17.59	12.70	17.74	0.000930	3.33	451.48	327.52	0.21
Main	179	200yr	1075.00	8.60	18.03	13.08	18.17	0.000856	3.31	611.88	391.69	0.20
Main	179	500yr	1207.00	8.60	18.55	13.35	18.65	0.000643	2.99	835.68	466.71	0.18
Main	244	2yr	201.00	10.20	12.62	12.62	13.31	0.029379	6.63	30.31	22.93	1.02
Main	244	5yr	338.00	10.20	13.31	13.20	14.13	0.022537	7.28	46.40	24.00	0.92
Main	244	10yr	449.00	10.20	14.42		14.99	0.009880	6.06	74.08	25.73	0.63
Main	244	25yr	612.00	10.20	15.92		16.36	0.005266	5.36	114.27	28.07	0.47
Main	244	50yr	750.00	10.20	17.02		17.43	0.003961	5.13	146.10	29.78	0.41
Main	244	100yr	904.00	10.20	17.46		17.95	0.004331	5.67	162.20	43.84	0.43
Main	244	200yr	1075.00	10.20	17.81		18.42	0.004875	6.27	181.46	74.00	0.46
Main	244	500yr	1207.00	10.20	18.30		18.88	0.004363	6.27	232.62	134.06	0.44
Main	309	2yr	201.00	11.23	14.11		14.41	0.010445	4.37	46.03	25.98	0.57
Main	309	5yr	338.00	11.23	14.71		15.18	0.011318	5.50	62.63	29.57	0.62
Main	309	10yr	449.00	11.23	15.11		15.70	0.011813	6.22	74.65	30.68	0.65
Main	309	25yr	612.00	11.23	16.25		16.77	0.006733	5.89	111.78	37.11	0.52
Main	309	50yr	750.00	11.23	17.26		17.72	0.004513	5.61	155.77	57.52	0.44
Main	309	100yr	904.00	11.23	17.74		18.24	0.004489	5.95	191.17	89.07	0.45
Main	309	200yr	1075.00	11.23	18.21		18.72	0.004296	6.15	240.59	119.81	0.45
Main	309	500yr	1207.00	11.23	18.71		19.15	0.003545	5.90	308.61	152.29	0.41
Main	384	2yr	201.00	12.65	14.83		15.23	0.010919	5.11	40.78	24.80	0.67
Main	384	5yr	338.00	12.65	15.45		16.06	0.011320	6.33	56.85	26.86	0.71
Main	384	10yr	449.00	12.65	15.86		16.62	0.011717	7.13	68.08	28.21	0.74
Main	384	25yr	612.00	12.65	16.62		17.45	0.009551	7.53	90.43	30.72	0.70
Main	384	50yr	750.00	12.65	17.44		18.22	0.006963	7.37	116.73	33.68	0.62
Main	384	100yr	904.00	12.65	17.86		18.78	0.007316	8.02	131.44	35.85	0.64
Main	384	200yr	1075.00	12.65	18.22		19.32	0.007984	8.79	144.75	37.71	0.68
Main	384	500yr	1207.00	12.65	18.57		19.75	0.007965	9.16	158.10	39.49	0.68
Main	458	2yr	201.00	13.13	15.52	14.82	15.77	0.004878	4.01	52.19	30.13	0.51
Main	458	5yr	338.00	13.13	16.24	15.34	16.59	0.004654	4.83	74.96	32.95	0.52
Main	458	10yr	449.00	13.13	16.74	15.70	17.17	0.004534	5.35	91.82	34.90	0.53
Main	458	25yr	612.00	13.13	17.43	16.19	17.94	0.004222	5.89	116.77	37.59	0.53
Main	458	50yr	750.00	13.13	18.07	16.55	18.61	0.003656	6.08	141.95	40.12	0.51
Main	458	100yr	904.00	13.13	18.58	16.93	19.19	0.003642	6.51	162.56	42.08	0.51
Main	458	200yr	1075.00	13.13	19.06	17.32	19.75	0.003705	6.98	183.22	43.96	0.53
Main	458	500yr	1207.00	13.13	19.44	17.62	20.18	0.003666	7.26	200.21	45.44	0.53


MysticStreet Plan: Proposed-Design 1/5/2018
Upstream end of study area (FEMA Cross Section F)
.06
.04
.07
Legend
WS 50yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
26
24
22
20
18
16
14
12
-80
-60
-40
-20
0
20
40
Station (ft)

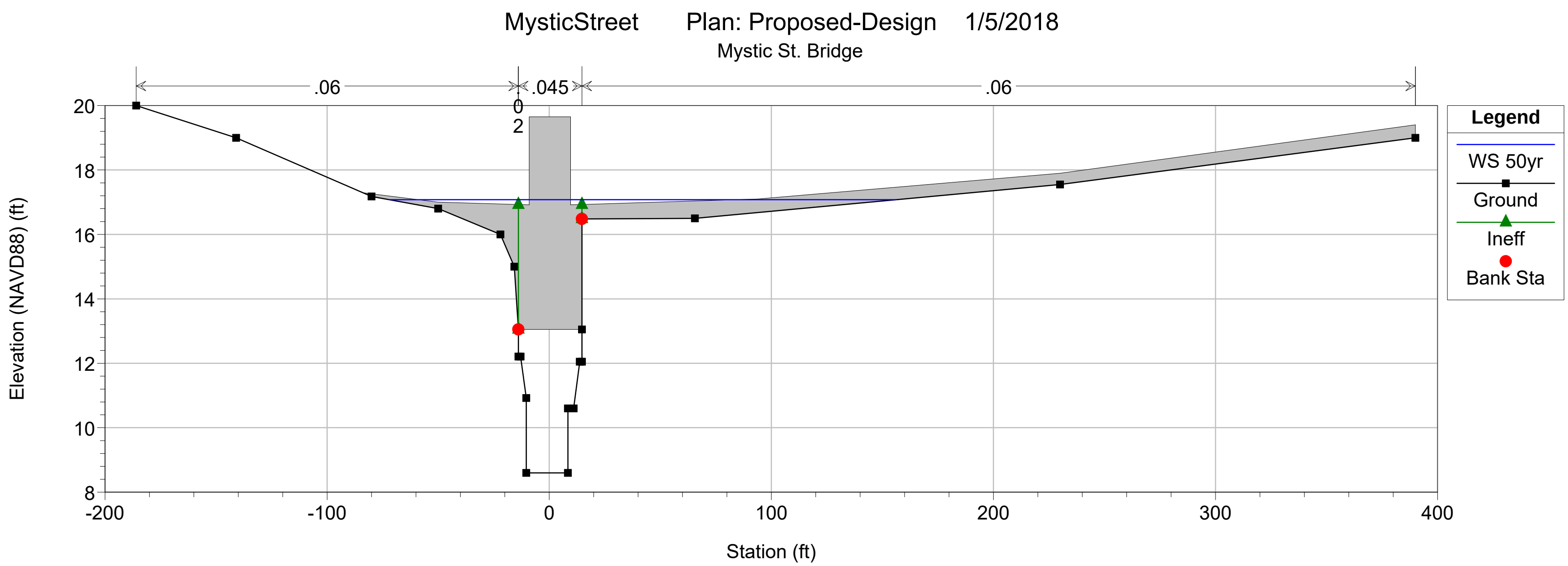

MysticStreet Plan: Proposed-Design 1/5/2018
204 FT upstream of Mysitc St. Bridge
.06
.045
.07
Legend
WS 50yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
26
24
22
20
18
16
14
12
-140
-120
-100
-80
-60
-40
-20
0
20
40
Station (ft)


MysticStreet Plan: Proposed-Design 1/5/2018
130 ft Upstream of Bridge
.06
.045
.06
Legend
WS 50yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)
26
24
22
20
18
16
14
12
10
-150
-100
-50
0
50
100
150

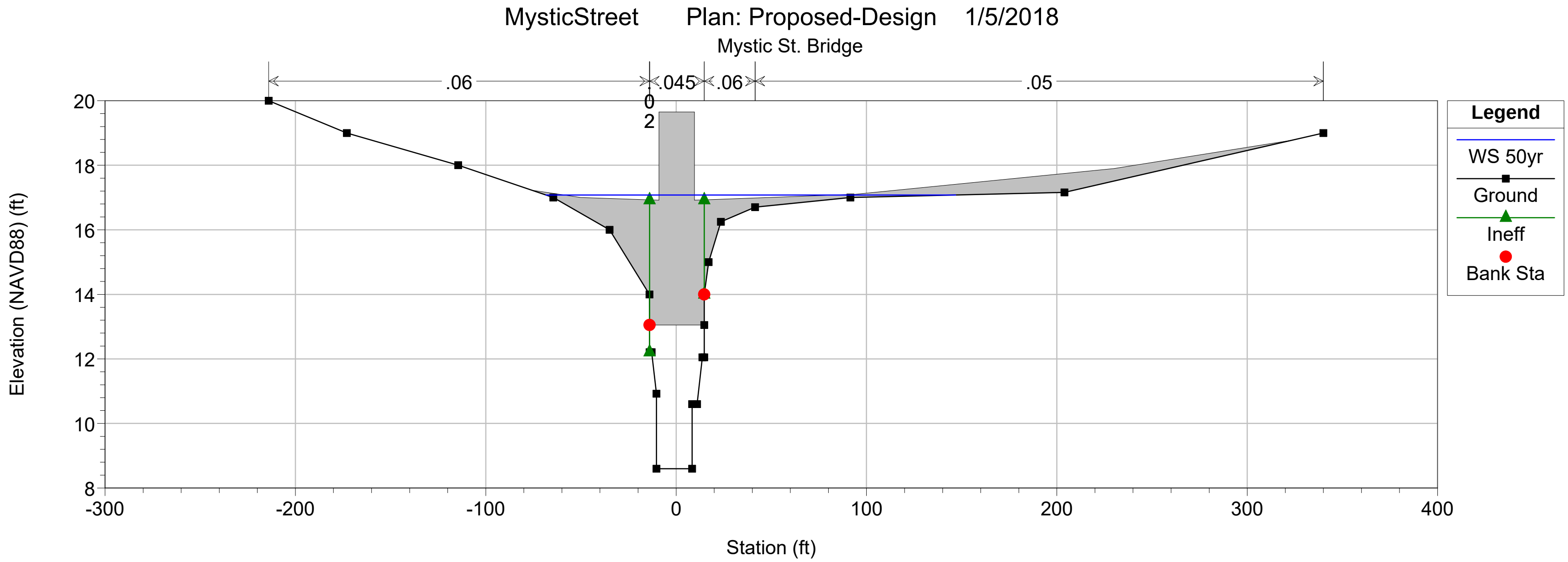

MysticStreet Plan: Proposed-Design 1/5/2018
65 Upstream of Mystic Bridge
.06
.045
.06
0
2
Legend
WS 50yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)
26
24
22
20
18
16
14
12
10
-150
-100
-50
0
50
100
150
200

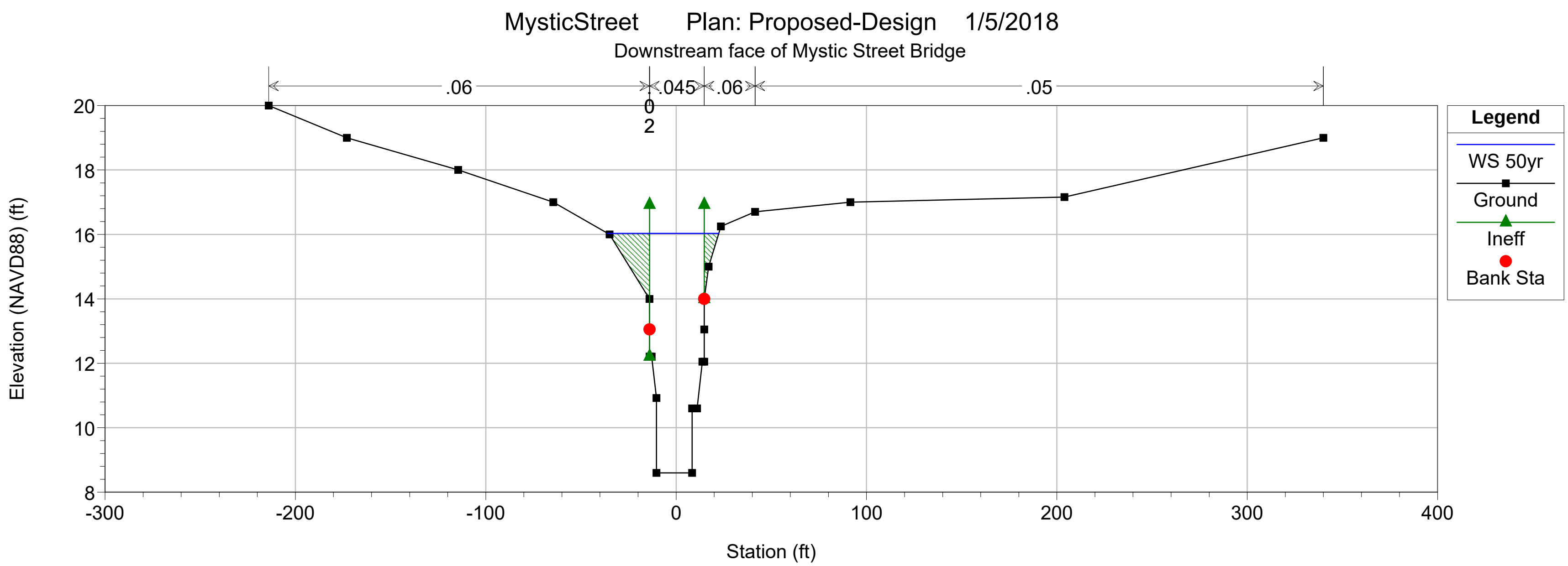


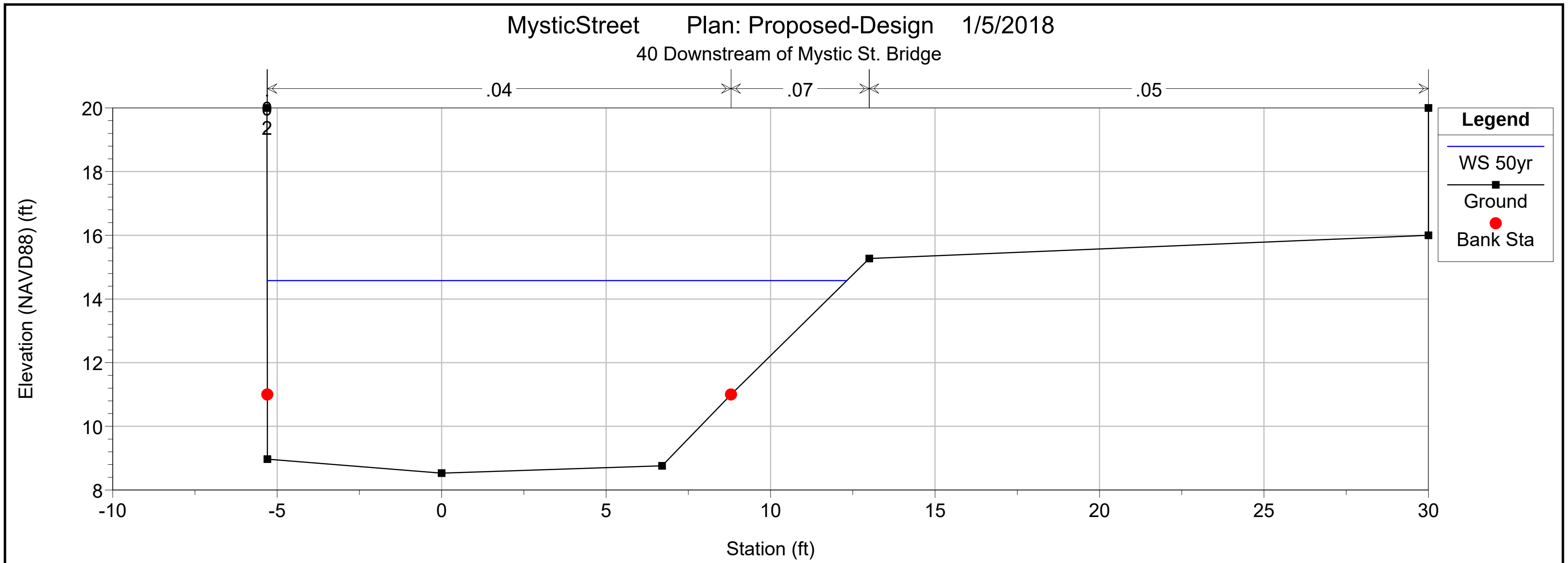
MysticStreet Plan: Proposed-Design 1/5/2018
Upstream face of Mystic Street Bridge
.06
.045
.06
0
2
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 50yr
Ground
Ineff
Bank Sta



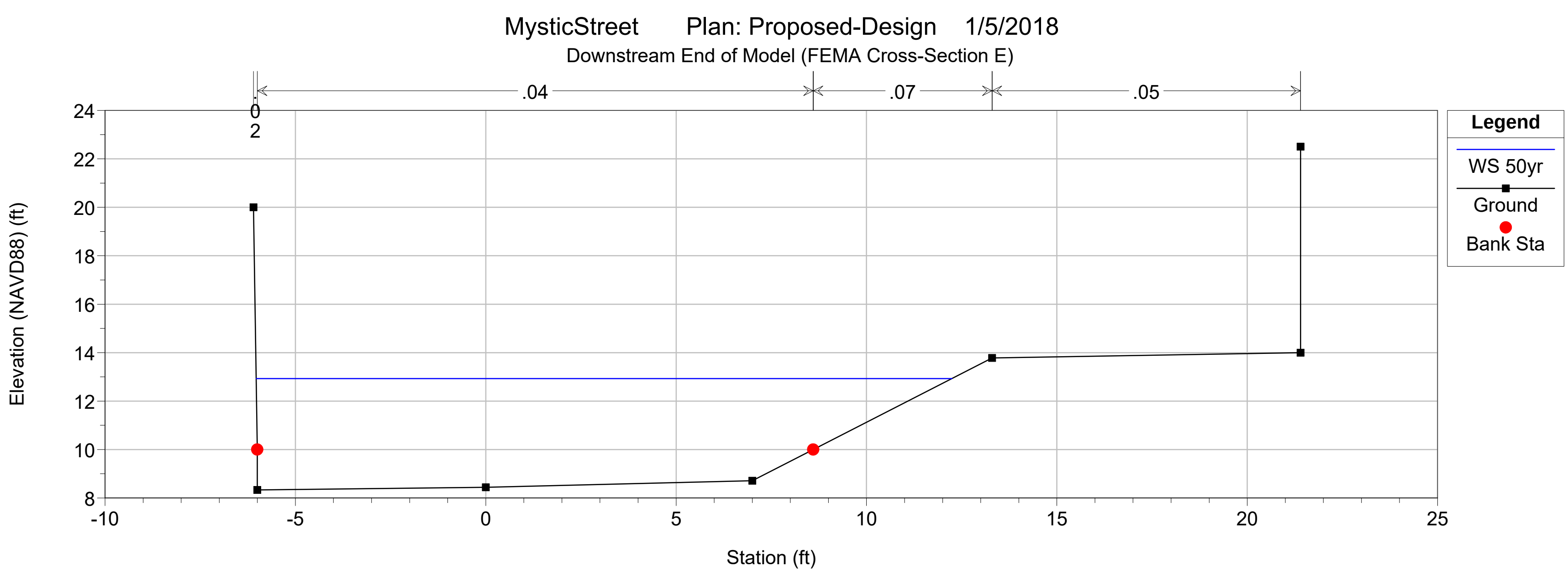
MysticStreet Plan: Proposed-Design 1/5/2018
Mystic St. Bridge
.06
.045
.06
0
2
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 50yr
Ground
Ineff
Bank Sta


MysticStreet Plan: Proposed-Design 1/5/2018
Mystic St. Bridge
.06
.045
.06
.05
Legend
WS 50yr
Ground
Ineff
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)
20
18
16
14
12
10
8
-300
-200
-100
0
100
200
300
400
0
2


MysticStreet Plan: Proposed-Design 1/5/2018
Downstream face of Mystic Street Bridge
.06
.045
.06
.05
Legend
WS 50yr
Ground
Ineff
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)
20
18
16
14
12
10
8
-300
-200
-100
0
100
200
300
400
0
2



MysticStreet Plan: Proposed-Design 1/5/2018
40 Downstream of Mystic St. Bridge
.04
.07
.05
Legend
WS 50yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)



MysticStreet Plan: Proposed-Design 1/5/2018
Downstream End of Model (FEMA Cross-Section E)
.04
.07
.05
Legend
WS 50yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)

Proposed Conditions -FEMA Flows

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X     X    X        X
X     X  X        X    X       X   X    X    X        X
X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: MysticStreet
Project File : MysticStreet.prj
Run Date and Time: 1/5/2018 2:14:45 PM

Project in English units

Project Description:
Project: Mystic Street Bridge Replacement in Arlington, MA
Done by: LEC and
RSV
Datum: NAVD88

PLAN DATA

Plan Title: Proposed-FEMA
Plan File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 01.02.18\MysticStreet.p07

Geometry Title: Proposed
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 01.02.18\MysticStreet.g03

Flow Title   : FEMA Flows
Flow File   : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 01.02.18\MysticStreet.f01

Plan Description:
Proposed conditions with FEMA Flows

Plan Summary Information:

Number of:					
	Cross Sections	= 8	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 1	Lateral Structures	=	0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations   = 20
Maximum difference tolerance   = 0.3

Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: FEMA Flows
Flow File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 01.02.18\MysticStreet.f01

Flow Data (cfs)

River	Reach	RS	10yr	50yr	100yr	500yr	200yr
Mill Brook	Main	458	150	310	450	730	540

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Mill Brook	Main	10yr	Normal S = 0.063	Known WS = 10
Mill Brook	Main	50yr	Normal S = 0.063	Known WS = 10.6
Mill Brook	Main	100yr	Normal S = 0.063	Known WS = 10.8
Mill Brook	Main	500yr	Normal S = 0.063	Known WS = 11.9
Mill Brook	Main	200yr	Normal S = 0.063	Known WS = 11.5

GEOMETRY DATA

Geometry Title: Proposed
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 01.02.18\MysticStreet.g03

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 458

INPUT
Description: Upstream end of study area (FEMA Cross Section F)
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-73.7	26	-32.7	24.59	-21.7	19.45	-11.2	14.3	-9.3	13.4
0	13.13	14.3	14.37	32.8	24.27				

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
   -73.7     .06   -11.2     .04    14.3     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -11.2    14.3               77      74      70              .1       .3

CROSS SECTION


RIVER: Mill Brook
REACH: Main               RS: 384

INPUT
Description: 204 FT upstream of Mysitc St. Bridge
Station Elevation Data    num=       8
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
  -121.1      26   -41.1    24.5   -16.1    17.3   -10.2    13.7    -8.5   12.65
       0   12.71    10.9   13.72    24.3   21.76

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
  -121.1     .06   -10.2    .045    10.9     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -10.2    10.9               67      74      78              .1       .3

CROSS SECTION


RIVER: Mill Brook
REACH: Main               RS: 309

INPUT
Description: 130 ft Upstream of Bridge
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    -135      26     -85    24.5     -34    17.3   -16.4   15.82   -14.5    14.8
     -13      14    -9.1   12.01       0   11.23     7.4   12.81    12.3      14
    15.6    14.8   15.61   17.11     125      19

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    -135     .06    -9.1    .045     7.4     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           -13    12.3               66      65      65              .1       .3

CROSS SECTION


RIVER: Mill Brook
REACH: Main               RS: 244

INPUT
Description: 65 Upstream of Mystic Bridge
Station Elevation Data    num=      10
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    -115      26     -63      22     -45      18     -33    17.5   -17.5   17.02
   -10.1   12.22       0    10.2    12.2   12.44    12.3   17.62     166      19

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
```

```
    -115     .06   -10.1    .045    12.2     .02    12.3     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         -17.5    12.3               66      66      66             .1       .3

CROSS SECTION


RIVER: Mill Brook
REACH: Main              RS: 179

INPUT
Description: Upstream face of Mystic Street Bridge
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    -186      20    -141      19     -80   17.18     -50    16.8     -22      16
   -15.7      15  -13.91   13.05   -13.9   12.21   -12.9   12.21  -10.32   10.92
  -10.32     8.6    8.43     8.6    8.43    10.6   11.01    10.6   13.76   12.05
   14.76   12.05   14.76   13.05   14.76   16.48      15   16.48    65.6    16.5
     230   17.55     390      19

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
    -186     .06  -13.91     .02   -13.9    .045   14.76     .06

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        -13.91   14.76               63      63      66             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    -186  -13.91   16.92       F
   14.76     390   16.92       F

BRIDGE


RIVER: Mill Brook
REACH: Main              RS: 140

INPUT
Description: Mystic St. Bridge
Distance from Upstream XS =      .5
Deck/Roadway Width        =      62
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=      16
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
    -107    17.5       0     -50      17       0   -13.9   16.93       0
   -13.9   16.93   13.05      -9   16.92   13.05      -9   19.65   13.05
    -8.6   19.65   13.05    -8.6   19.65   13.05       0   19.65   13.05
     9.6   19.65   13.05     9.6   16.92   13.05    14.9   16.93   13.05
    14.9   16.93       0      94    17.1       0     230    17.9
     390    19.4

Upstream Bridge Cross Section Data
Station Elevation Data    num=      22
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    -186      20    -141      19     -80   17.18     -50    16.8     -22      16
   -15.7      15  -13.91   13.05   -13.9   12.21   -12.9   12.21  -10.32   10.92
  -10.32     8.6    8.43     8.6    8.43    10.6   11.01    10.6   13.76   12.05
   14.76   12.05   14.76   13.05   14.76   16.48      15   16.48    65.6    16.5
     230   17.55     390      19

Manning's n Values        num=       4
```

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-186	.06	-13.91	.02	-13.9	.045	14.76	.06

Bank Sta: Left Right Coeff Contr. Expan.

Left	Right	Coeff Contr.	Expan.
-13.91	14.76	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-186	-13.91	16.92	F
14.76	390	16.92	F

Downstream Deck/Roadway Coordinates

num= 16

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-107	17.5	0	-50	17	0	-13.9	16.93	0
-13.9	16.93	13.05	-9	16.92	13.05	-9	19.65	13.05
-8.6	19.65	13.05	-8.6	19.65	13.05	0	19.65	13.05
9.6	19.65	13.05	9.6	16.92	13.05	14.9	16.93	13.05
14.9	16.93	0	94	17.1	0	230	17.9	
390	19.4							

Downstream Bridge Cross Section Data

Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-214	20	-173	19	-114.5	18	-64.5	17	-35	16
-14	14	-13.91	13.05	-13.9	12.21	-12.9	12.21	-10.32	10.92
-10.32	8.6	8.43	8.6	8.43	10.6	11.01	10.6	13.76	12.05
14.76	12.05	14.76	13.05	14.76	14	17.1	15	23.5	16.25
41.5	16.7	91.5	17	204	17.16	340	19		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-214	.06	-14	.02	-13.91	.02	-13.9	.045	14.76	.06
41.5	.05								

Bank Sta: Left Right Coeff Contr. Expan.

Left	Right	Coeff Contr.	Expan.
-13.91	14.76	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-214	-13.9	16.92	F
14.76	340	16.92	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins = 16.92
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters
Add Friction component to Momentum

Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 115

INPUT
Description: Downstream face of Mystic Street Bridge
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-214	20	-173	19	-114.5	18	-64.5	17	-35	16
-14	14	-13.91	13.05	-13.9	12.21	-12.9	12.21	-10.32	10.92
-10.32	8.6	8.43	8.6	8.43	10.6	11.01	10.6	13.76	12.05
14.76	12.05	14.76	13.05	14.76	14	17.1	15	23.5	16.25
41.5	16.7	91.5	17	204	17.16	340	19		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-214	.06	-14	.02	-13.91	.02	-13.9	.045	14.76	.06
41.5	.05								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-13.91	14.76	45	40	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-214	-13.9	16.92	F
14.76	340	16.92	F

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 75

INPUT
Description: 40 Downstream of Mystic St. Bridge
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-5.31	20	-5.3	11	-5.3	8.97	0	8.53	6.7	8.76
8.8	11	13	15.27	30	16	30	20		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-5.31	.02	-5.3	.04	8.8	.07	13	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-5.3	8.8	75	75	74	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 0

INPUT
Description: Downstream End of Model (FEMA Cross-Section E)
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

-6.1	20	-6	10	-6	8.33	0	8.44	7	8.71
8.6	10	13.3	13.78	21.4	14	21.4	22.5		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-6.1	.02	-6	.04	8.6	.07	13.3	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-6	8.6	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Mill Brook

Reach	River Sta.	n1	n2	n3	n4	n5	n6
Main	458	.06	.04	.07			
Main	384	.06	.045	.07			
Main	309	.06	.045	.06			
Main	244	.06	.045	.02	.06		
Main	179	.06	.02	.045	.06		
Main	140	Bridge					
Main	115	.06	.02	.02	.045	.06	.05
Main	75	.02	.04	.07	.05		
Main	0	.02	.04	.07	.05		

SUMMARY OF REACH LENGTHS

River: Mill Brook

Reach	River Sta.	Left	Channel	Right
Main	458	77	74	70
Main	384	67	74	78
Main	309	66	65	65
Main	244	66	66	66
Main	179	63	63	66
Main	140	Bridge		
Main	115	45	40	30
Main	75	75	75	74
Main	0	0	0	0

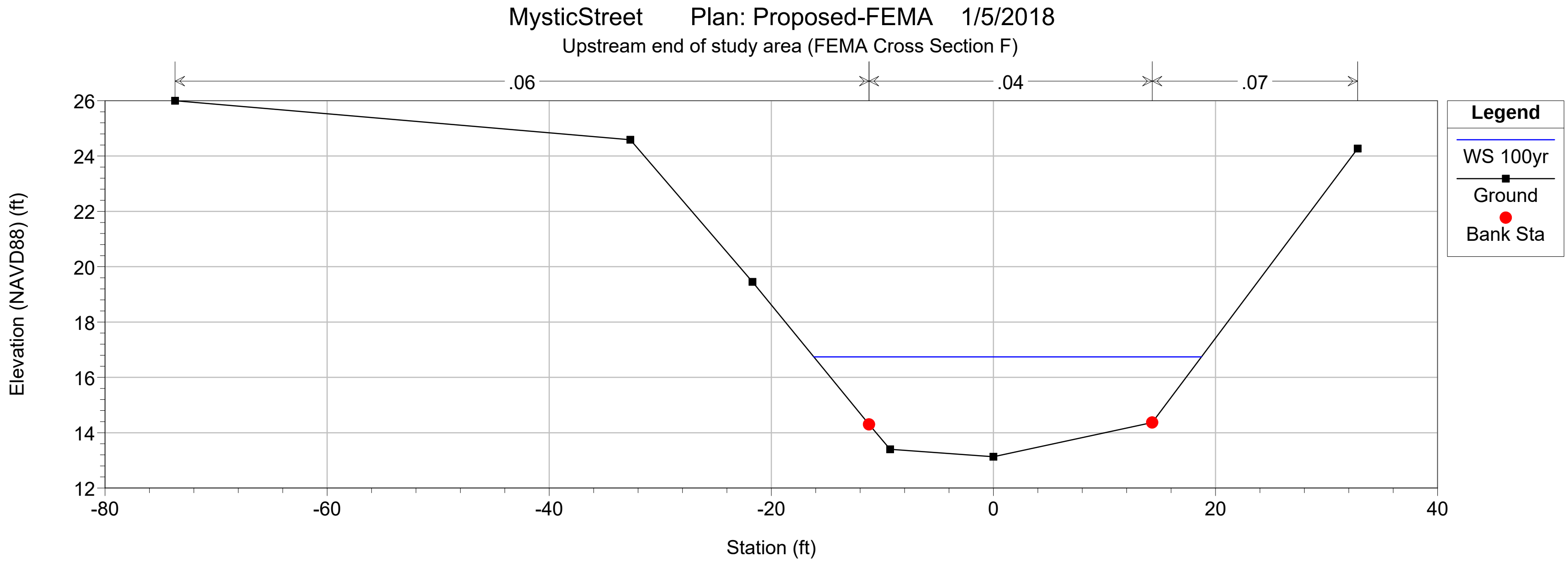
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Mill Brook

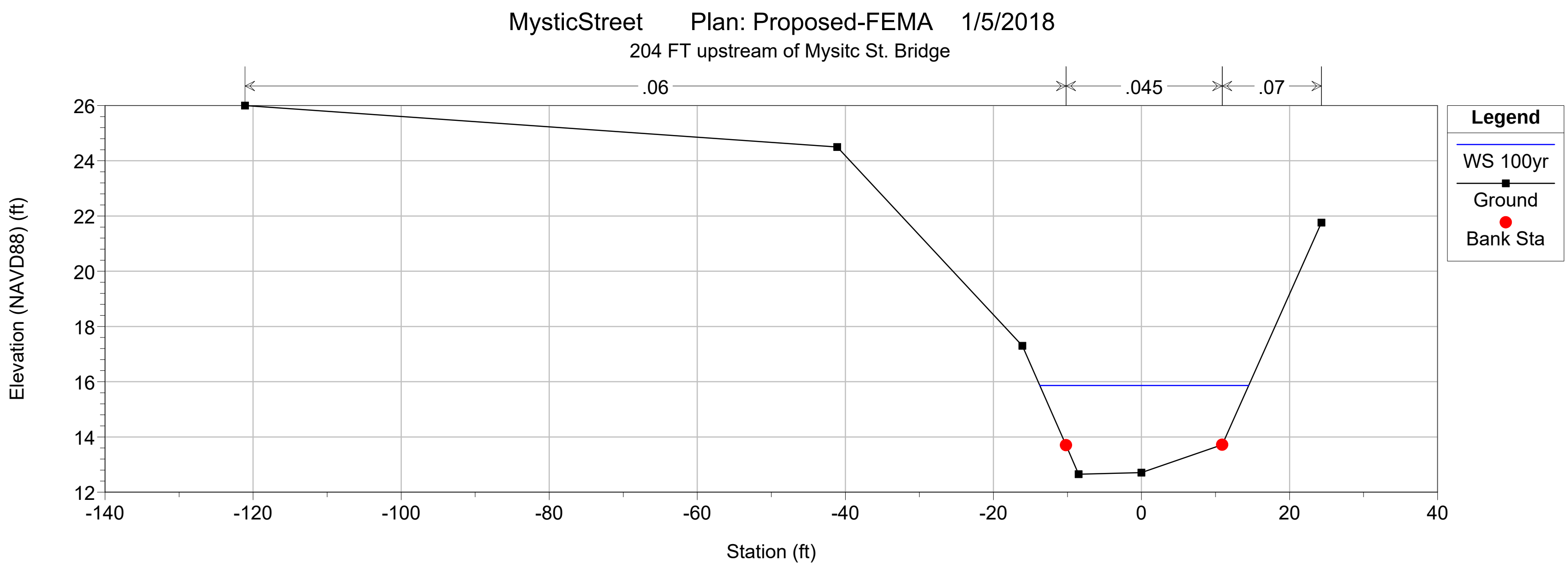
Reach	River Sta.	Contr.	Expan.
Main	458	.1	.3
Main	384	.1	.3
Main	309	.1	.3
Main	244	.1	.3
Main	179	.3	.5

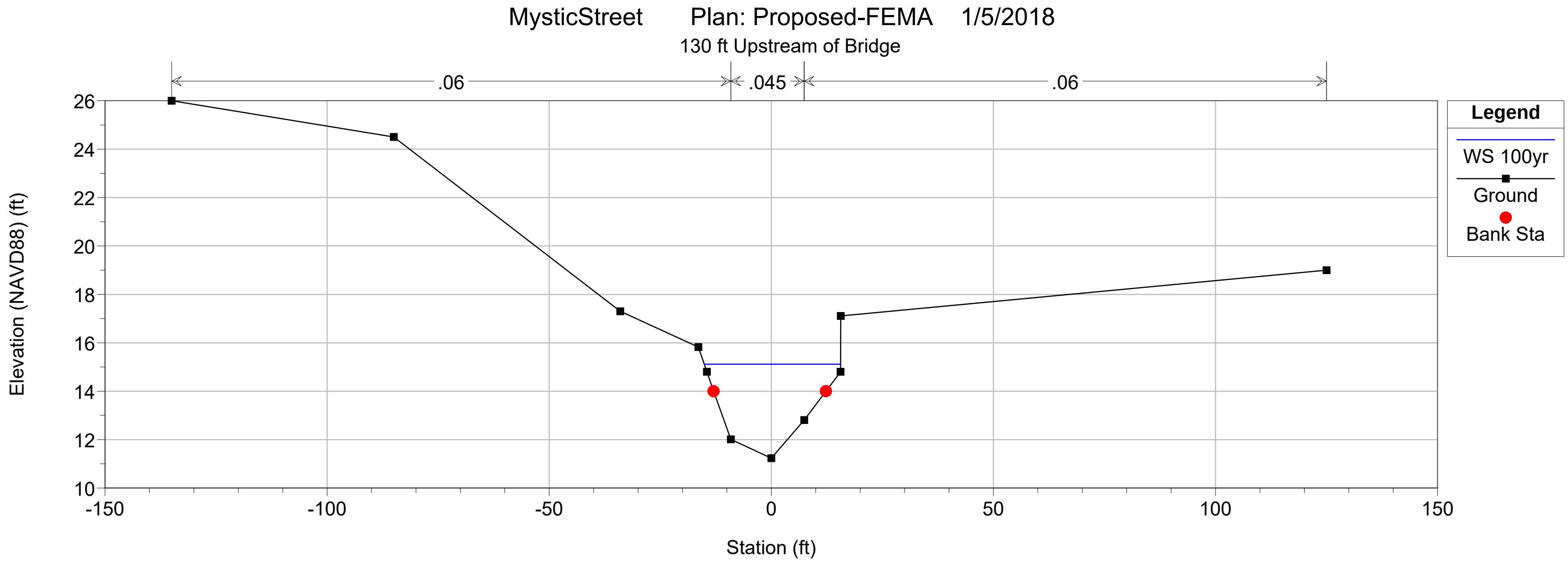
Main	**140**	**Bridge**	
Main	**115**	**.3**	**.5**
Main	**75**	**.1**	**.3**
Main	**0**	**.1**	**.3**

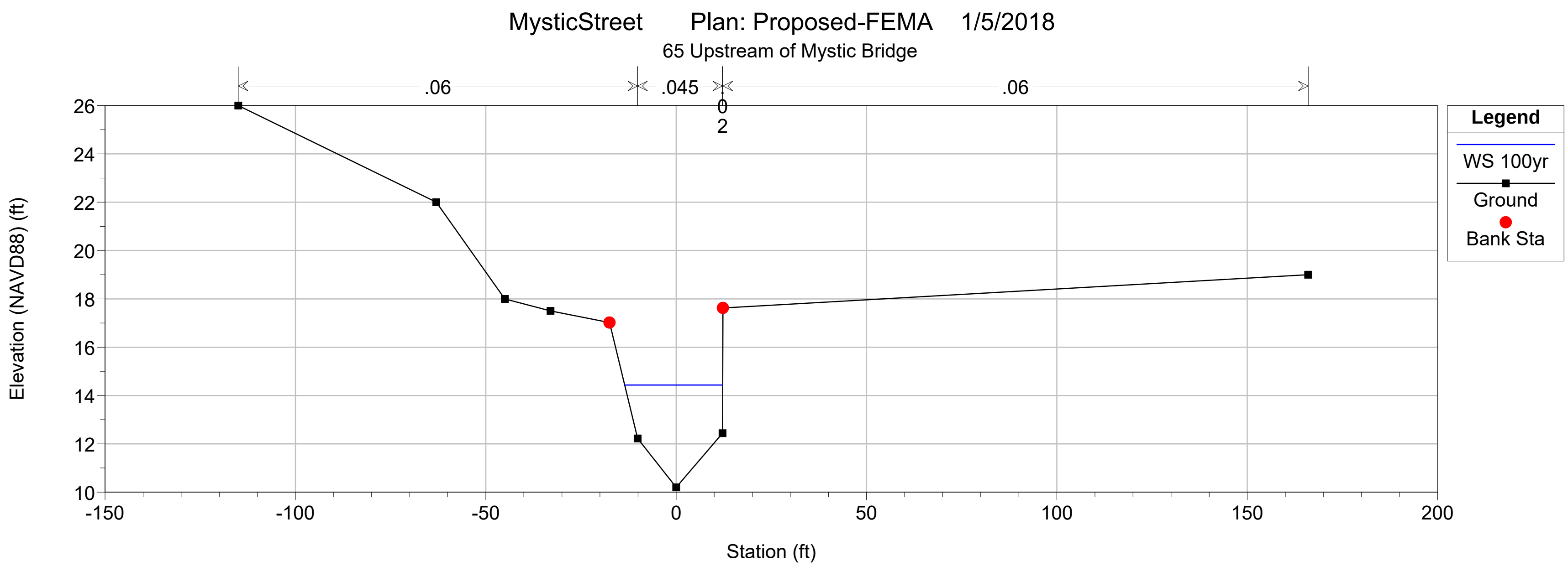
HEC-RAS Plan: Proposed-FEM River: Mill Brook Reach: Main

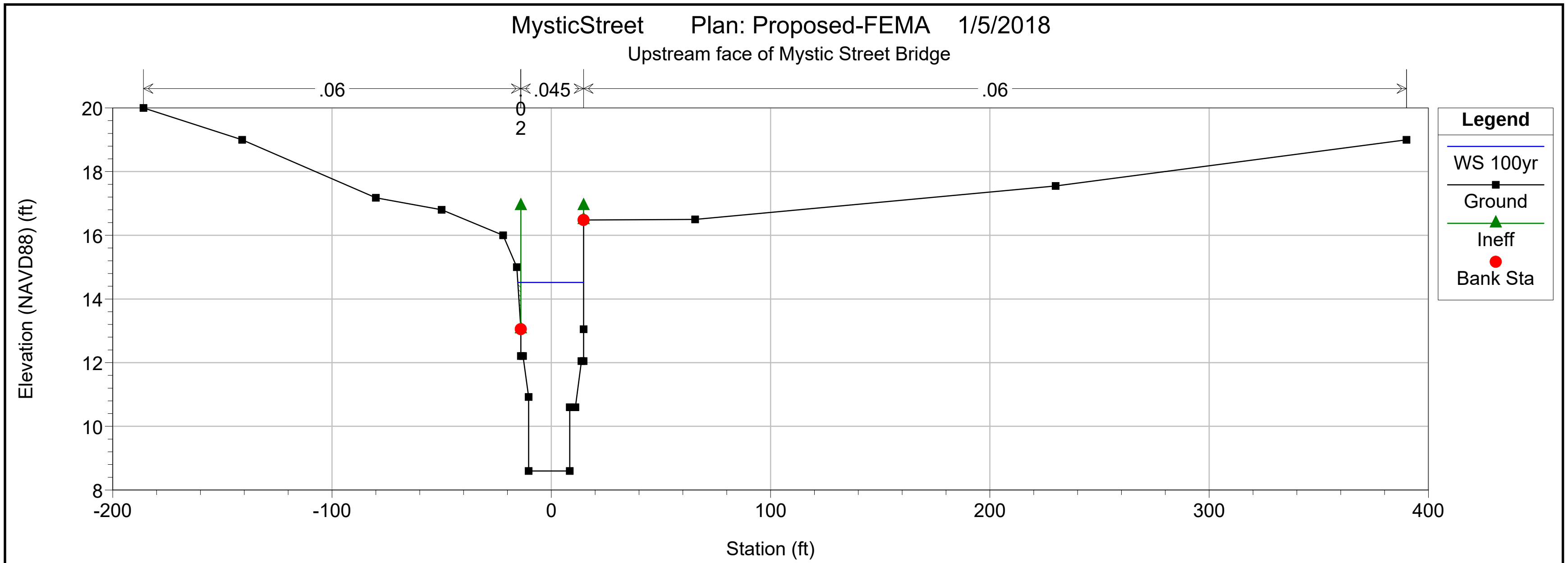
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	0	10yr	150.00	8.33	10.07	10.07	10.81	0.024644	6.93	21.66	14.68	1.00
Main	0	50yr	310.00	8.33	11.00	11.00	12.19	0.020657	8.77	35.85	15.85	1.00
Main	0	100yr	450.00	8.33	11.67	11.67	13.18	0.018842	9.88	46.90	16.70	0.99
Main	0	500yr	730.00	8.33	12.86	12.86	14.86	0.016461	11.46	67.51	18.18	0.98
Main	75	10yr	150.00	8.53	11.31	10.35	11.61	0.005396	4.35	34.52	14.41	0.49
Main	75	50yr	310.00	8.53	12.46		13.04	0.006347	6.10	51.70	15.54	0.57
Main	75	100yr	450.00	8.53	13.24	12.03	14.05	0.006868	7.23	64.16	16.31	0.61
Main	75	500yr	730.00	8.53	14.50	13.26	15.74	0.007657	9.04	85.39	17.54	0.67
Main	115	10yr	150.00	8.60	11.70	9.86	11.79	0.001938	2.39	62.75	24.98	0.27
Main	115	50yr	310.00	8.60	13.15	10.72	13.30	0.001940	3.00	103.18	28.68	0.28
Main	115	100yr	450.00	8.60	14.19	11.29	14.37	0.001822	3.39	132.75	31.16	0.28
Main	115	500yr	730.00	8.60	15.92	12.28	16.17	0.001663	4.00	182.40	55.95	0.28
Main	140		Bridge									
Main	179	10yr	150.00	8.60	11.83	9.86	11.91	0.001687	2.28	65.89	25.47	0.25
Main	179	50yr	310.00	8.60	13.25	10.72	13.39	0.001801	2.93	105.91	28.85	0.27
Main	179	100yr	450.00	8.60	14.52	11.29	14.68	0.001489	3.16	142.24	30.02	0.25
Main	179	500yr	730.00	8.60	16.98	12.28	17.14	0.000998	3.27	287.10	204.01	0.21
Main	244	10yr	150.00	10.20	12.38	12.38	12.95	0.030292	6.07	24.73	22.20	1.01
Main	244	50yr	310.00	10.20	13.10	13.10	13.97	0.026946	7.50	41.32	23.66	1.00
Main	244	100yr	450.00	10.20	14.43		15.00	0.009830	6.05	74.32	25.75	0.63
Main	244	500yr	730.00	10.20	16.92		17.33	0.003963	5.10	143.27	29.64	0.41
Main	309	10yr	150.00	11.23	13.79		14.03	0.010053	3.95	37.98	24.04	0.55
Main	309	50yr	310.00	11.23	14.64		15.06	0.010601	5.21	60.44	29.12	0.60
Main	309	100yr	450.00	11.23	15.11		15.71	0.011780	6.22	74.83	30.69	0.65
Main	309	500yr	730.00	11.23	17.16		17.62	0.004553	5.56	150.71	51.02	0.44
Main	384	10yr	150.00	12.65	14.52		14.85	0.011413	4.62	33.25	23.78	0.66
Main	384	50yr	310.00	12.65	15.34		15.90	0.011167	6.09	53.89	26.49	0.70
Main	384	100yr	450.00	12.65	15.86		16.63	0.011716	7.14	68.19	28.22	0.74
Main	384	500yr	730.00	12.65	17.35		18.13	0.007083	7.33	113.76	33.22	0.62
Main	458	10yr	150.00	13.13	15.20		15.40	0.005033	3.61	42.70	28.88	0.50
Main	458	50yr	310.00	13.13	16.11		16.44	0.004688	4.68	70.53	32.43	0.52
Main	458	100yr	450.00	13.13	16.74		17.17	0.004533	5.35	91.97	34.91	0.53
Main	458	500yr	730.00	13.13	17.99		18.52	0.003704	6.04	138.59	39.79	0.51


MysticStreet Plan: Proposed-FEMA 1/5/2018
Upstream end of study area (FEMA Cross Section F)
.06
.04
.07
Legend
WS 100yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)

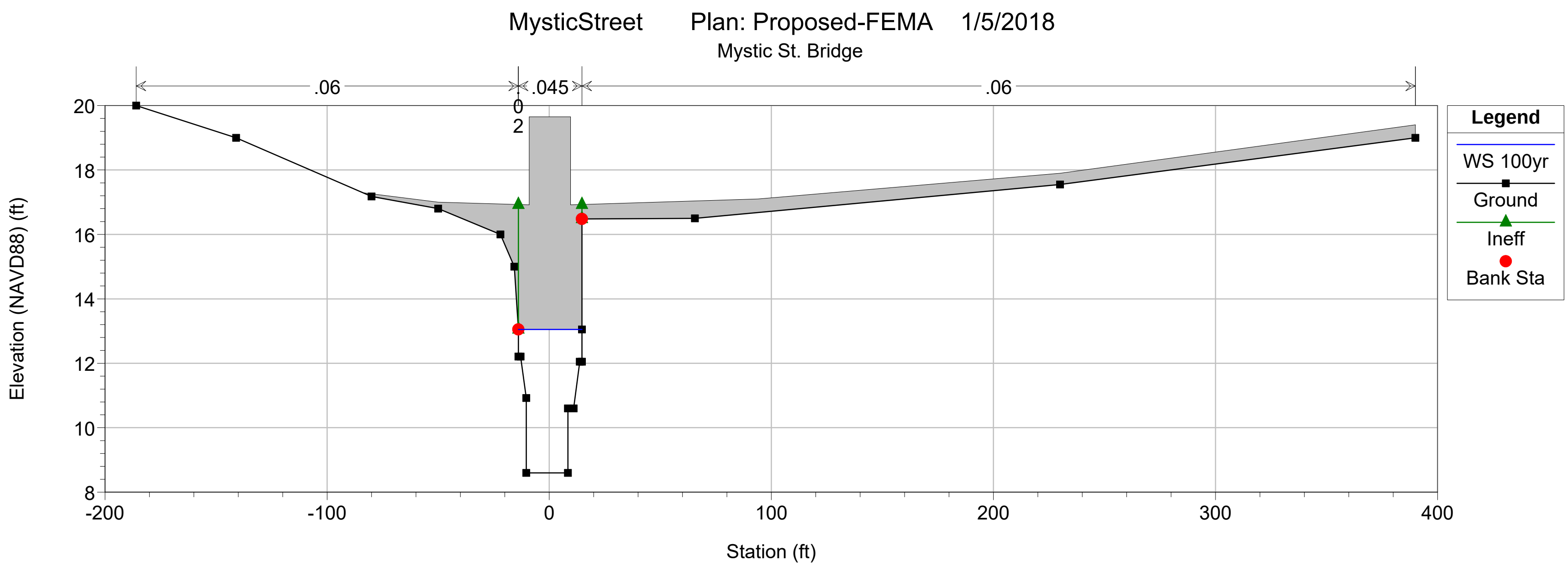

MysticStreet Plan: Proposed-FEMA 1/5/2018
204 FT upstream of Mysitc St. Bridge
.06
.045
.07
Legend
WS 100yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)


MysticStreet Plan: Proposed-FEMA 1/5/2018
130 ft Upstream of Bridge
.06
.045
.06
Legend
WS 100yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)

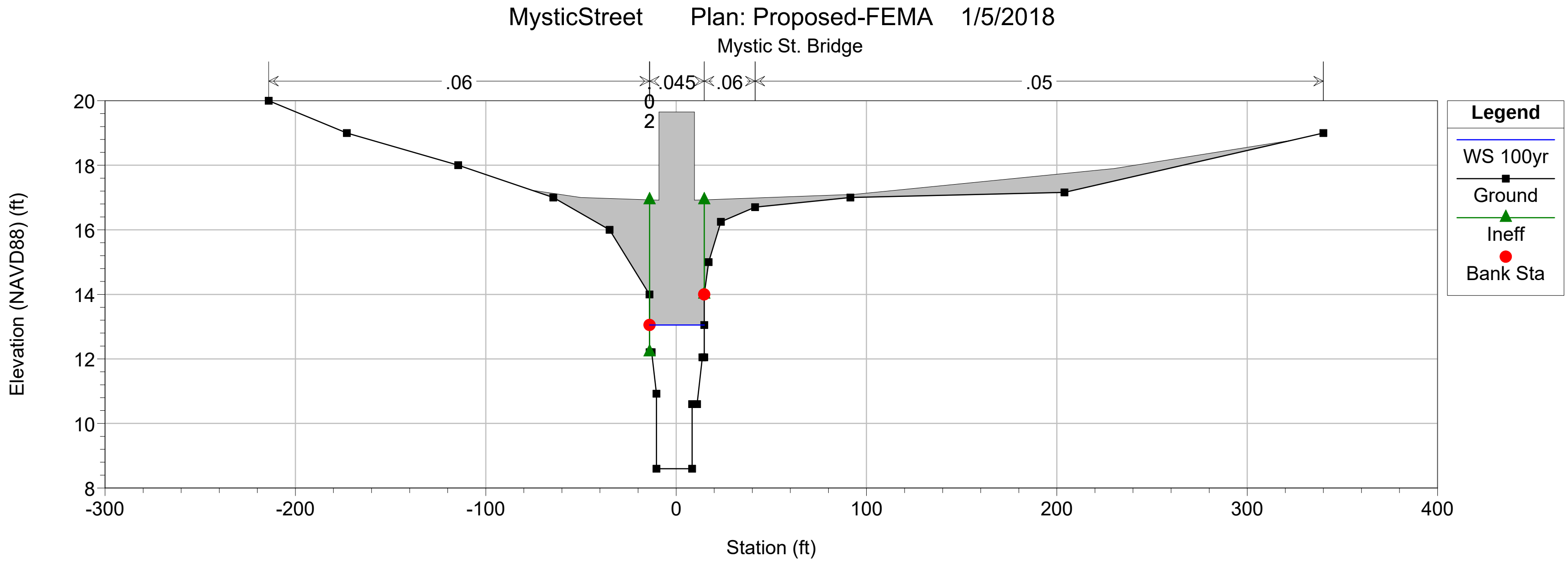

MysticStreet Plan: Proposed-FEMA 1/5/2018
65 Upstream of Mystic Bridge
.06
.045
0
2
.06
Legend
WS 100yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)



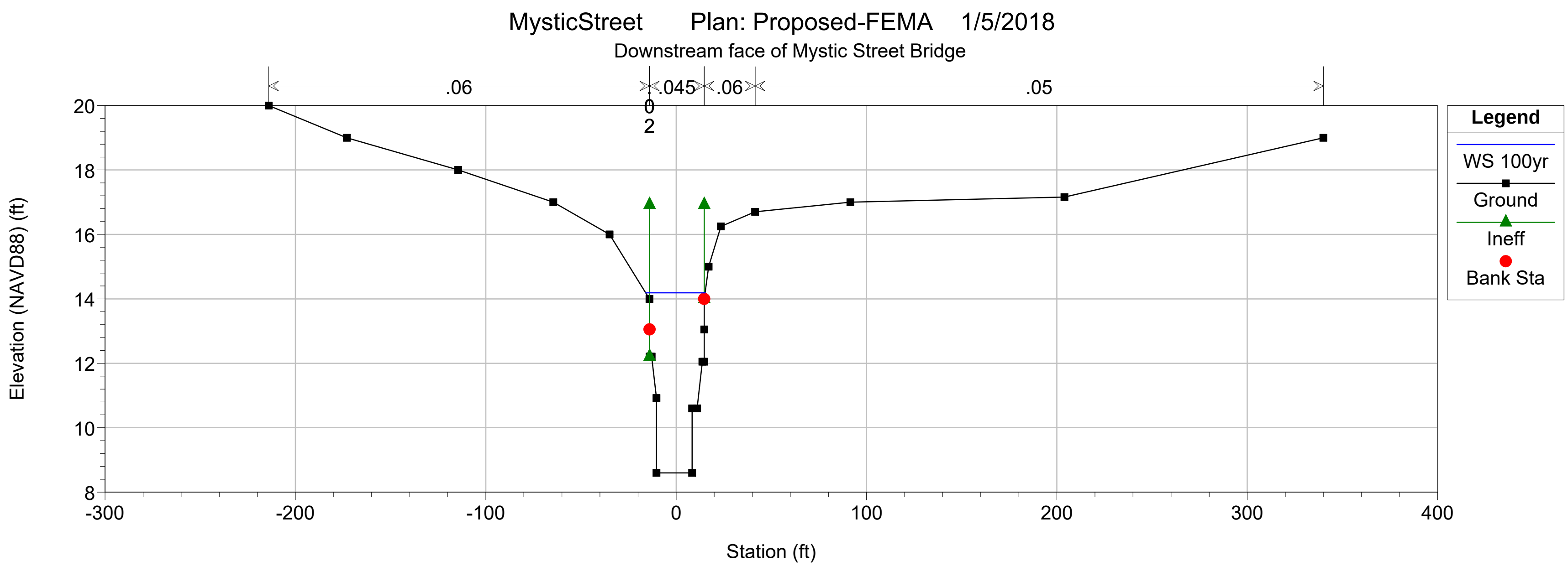
MysticStreet Plan: Proposed-FEMA 1/5/2018
Upstream face of Mystic Street Bridge
.06
.045
.06
0
2
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
Ground
Ineff
Bank Sta



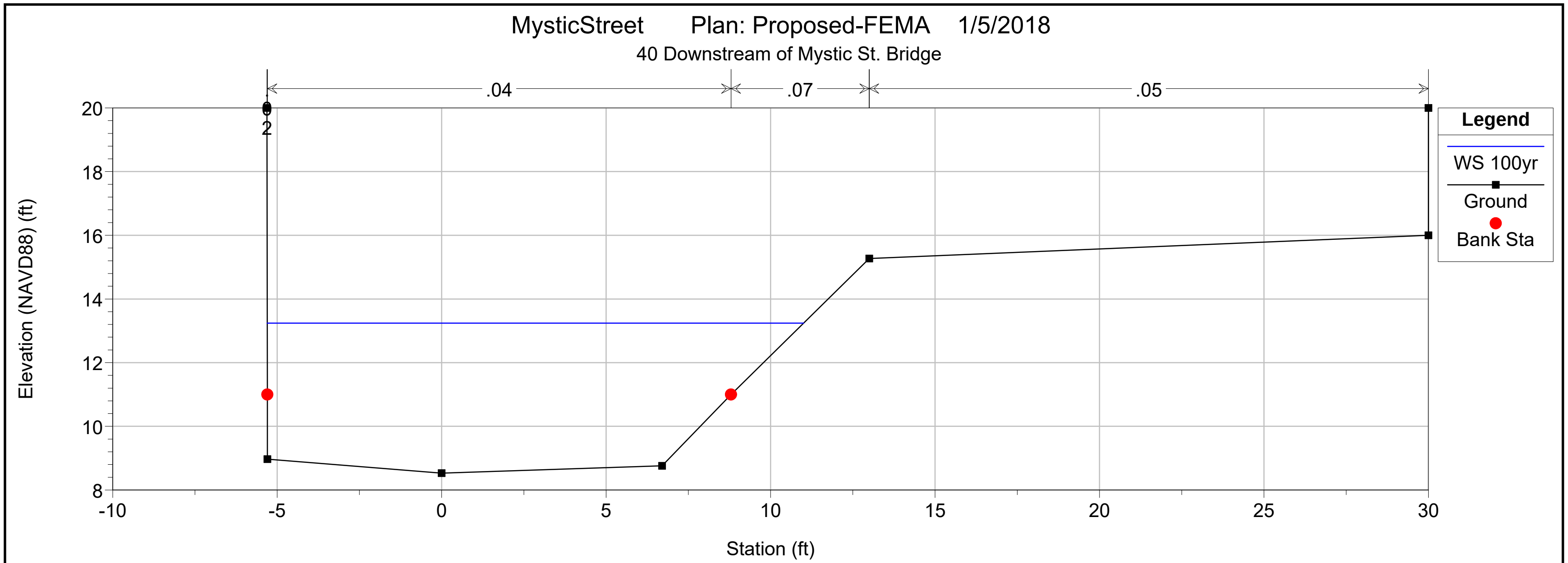
MysticStreet Plan: Proposed-FEMA 1/5/2018
Mystic St. Bridge
.06
.045
.06
0
2
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
Ground
Ineff
Bank Sta

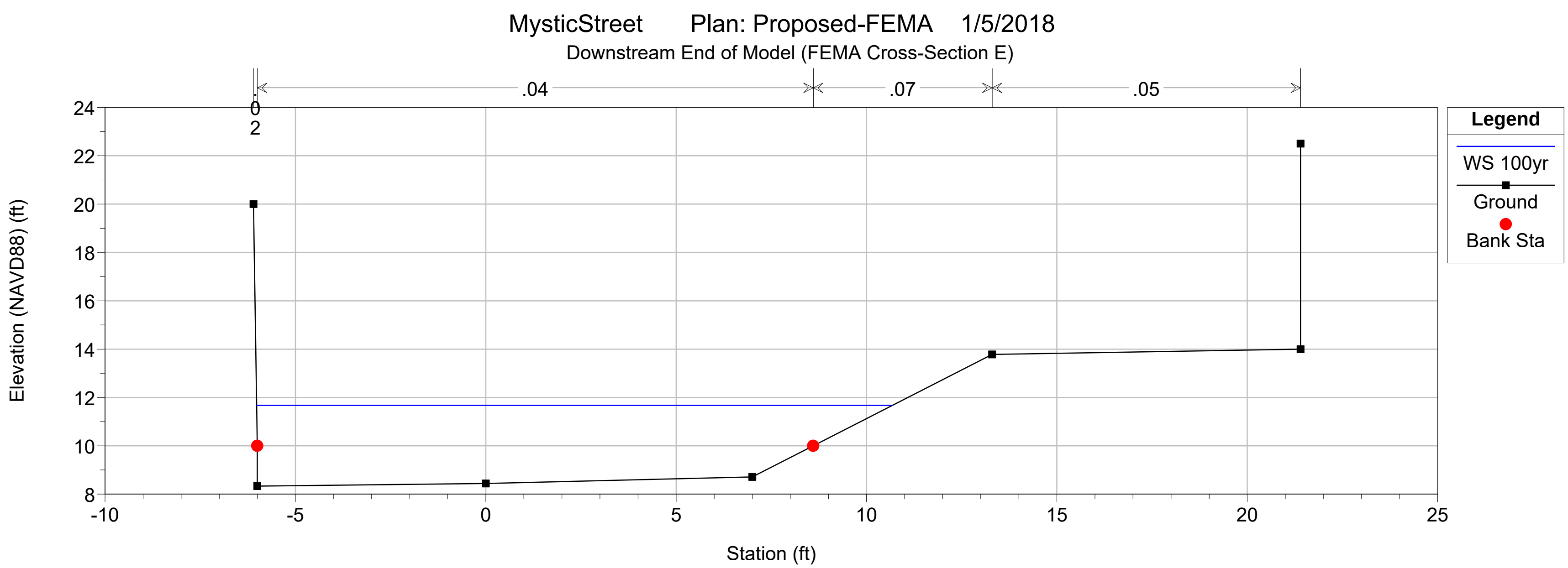


MysticStreet Plan: Proposed-FEMA 1/5/2018
Mystic St. Bridge
.06
.045
.06
.05
Legend
WS 100yr
Ground
Ineff
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)



MysticStreet Plan: Proposed-FEMA 1/5/2018
Downstream face of Mystic Street Bridge
.06
.045
.06
.05
Legend
WS 100yr
Ground
Ineff
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)


MysticStreet Plan: Proposed-FEMA 1/5/2018
40 Downstream of Mystic St. Bridge
.04
.07
.05
Legend
WS 100yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)


MysticStreet Plan: Proposed-FEMA 1/5/2018
Downstream End of Model (FEMA Cross-Section E)
.04
.07
.05
Legend
WS 100yr
Ground
Bank Sta
Elevation (NAVD88) (ft)
Station (ft)

Proposed Conditions -Floodway

```
                    HEC-RAS Version 4.1.0 Jan 2010
                     U.S. Army Corps of Engineers
                    Hydrologic Engineering Center
                          609 Second Street
                          Davis, California

     X     X  XXXXXX    XXXX        XXXX       XX      XXXX
     X     X  X        X    X       X   X     X  X    X
     X     X  X        X            X   X    X    X   X
     XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
     X     X  X        X            X  X     X    X        X
     X     X  X        X    X       X   X    X    X        X
     X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: MysticStreet
Project File : MysticStreet.prj
Run Date and Time: 1/5/2018 2:09:12 PM

Project in English units

Project Description:
Project: Mystic Street Bridge Replacement in Arlington, MA
Done by: LEC and
RSV
Datum: NAVD88

PLAN DATA

Plan Title: Proposed - Floodway
Plan File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 01.02.18\MysticStreet.p02

Geometry Title: Proposed
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 01.02.18\MysticStreet.g03

Flow Title   : FEMA Floodway Flows
Flow File   : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 01.02.18\MysticStreet.f02

Plan Description:
Proposed conditions with FEMA Flows

Plan Summary Information:

```
Number of:  Cross Sections =    8    Multiple Openings  =    0
            Culverts       =    0    Inline Structures  =    0
            Bridges        =    1    Lateral Structures =    0
```

Computational Information

```
    Water surface calculation tolerance  =  0.01
    Critical depth calculation tolerance =  0.01
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
```

Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = Mill Brook Reach = Main

RS	Profile	Method	Value1	Value2
458	100yr Floodway	1	-17	22
384	100yr Floodway	1	-36	24
309	100yr Floodway	1	-38	48
244	100yr Floodway	1	-25	35
179	100yr Floodway	1	-45	25
115	100yr Floodway	1	-25	17
75	100yr Floodway	1	-25	11
0	100yr Floodway	1	-45	18

FLOW DATA

Flow Title: FEMA Floodway Flows
Flow File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 01.02.18\MysticStreet.f02

Flow Data (cfs)

River	Reach	RS	100yr	100yr Floodway
Mill Brook	Main	458	450	450

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Mill Brook	Main	100yr	Normal S = 0.063	Known WS = 10.8
Mill Brook	Main	100yr Floodway	Normal S = 0.063	Known WS = 10.9

GEOMETRY DATA

Geometry Title: Proposed
Geometry File : p:\MA_PeabodyOldServer\Arlington\Mystic Bridge Survey\Hydraulics\HEC-RAS\HEC-RAS 01.02.18\MysticStreet.g03

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 458

INPUT
Description: Upstream end of study area (FEMA Cross Section F)
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-73.7	26	-32.7	24.59	-21.7	19.45	-11.2	14.3	-9.3	13.4
0	13.13	14.3	14.37	32.8	24.27				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-73.7	.06	-11.2	.04	14.3	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-11.2	14.3	77	74	70	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 384

INPUT
Description: 204 FT upstream of Mysitc St. Bridge
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-121.1	26	-41.1	24.5	-16.1	17.3	-10.2	13.7	-8.5	12.65
0	12.71	10.9	13.72	24.3	21.76				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-121.1	.06	-10.2	.045	10.9	.07

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-10.2	10.9	67	74	78	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 309

INPUT
Description: 130 ft Upstream of Bridge
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-135	26	-85	24.5	-34	17.3	-16.4	15.82	-14.5	14.8
-13	14	-9.1	12.01	0	11.23	7.4	12.81	12.3	14
15.6	14.8	15.61	17.11	125	19				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
-135	.06	-9.1	.045	7.4	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-13	12.3	66	65	65	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 244

INPUT

Description: 65 Upstream of Mystic Bridge
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-115	26	-63	22	-45	18	-33	17.5	-17.5	17.02
-10.1	12.22	0	10.2	12.2	12.44	12.3	17.62	166	19

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-115	.06	-10.1	.045	12.2	.02	12.3	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-17.5	12.3	66	66	66	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 179

INPUT
Description: Upstream face of Mystic Street Bridge
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-186	20	-141	19	-80	17.18	-50	16.8	-22	16
-15.7	15	-13.91	13.05	-13.9	12.21	-12.9	12.21	-10.32	10.92
-10.32	8.6	8.43	8.6	8.43	10.6	11.01	10.6	13.76	12.05
14.76	12.05	14.76	13.05	14.76	16.48	15	16.48	65.6	16.5
230	17.55	390	19						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-186	.06	-13.91	.02	-13.9	.045	14.76	.06

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-13.91	14.76	63	63	66	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-186	-13.91	16.92	F
14.76	390	16.92	F

BRIDGE

RIVER: Mill Brook
REACH: Main RS: 140

INPUT
Description: Mystic St. Bridge
Distance from Upstream XS = .5
Deck/Roadway Width = 62
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 16

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-107	17.5	0	-50	17	0	-13.9	16.93	0
-13.9	16.93	13.05	-9	16.92	13.05	-9	19.65	13.05
-8.6	19.65	13.05	-8.6	19.65	13.05	0	19.65	13.05
9.6	19.65	13.05	9.6	16.92	13.05	14.9	16.93	13.05
14.9	16.93	0	94	17.1	0	230	17.9	
390	19.4							

Upstream Bridge Cross Section Data
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-186	20	-141	19	-80	17.18	-50	16.8	-22	16
-15.7	15	-13.91	13.05	-13.9	12.21	-12.9	12.21	-10.32	10.92
-10.32	8.6	8.43	8.6	8.43	10.6	11.01	10.6	13.76	12.05
14.76	12.05	14.76	13.05	14.76	16.48	15	16.48	65.6	16.5
230	17.55	390	19						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-186	.06	-13.91	.02	-13.9	.045	14.76	.06

Bank Sta: Left	Right	Coeff Contr.	Expan.
-13.91	14.76	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-186	-13.91	16.92	F
14.76	390	16.92	F

Downstream Deck/Roadway Coordinates
num= 16

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-107	17.5	0	-50	17	0	-13.9	16.93	0
-13.9	16.93	13.05	-9	16.92	13.05	-9	19.65	13.05
-8.6	19.65	13.05	-8.6	19.65	13.05	0	19.65	13.05
9.6	19.65	13.05	9.6	16.92	13.05	14.9	16.93	13.05
14.9	16.93	0	94	17.1	0	230	17.9	
390	19.4							

Downstream Bridge Cross Section Data
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-214	20	-173	19	-114.5	18	-64.5	17	-35	16
-14	14	-13.91	13.05	-13.9	12.21	-12.9	12.21	-10.32	10.92
-10.32	8.6	8.43	8.6	8.43	10.6	11.01	10.6	13.76	12.05
14.76	12.05	14.76	13.05	14.76	14	17.1	15	23.5	16.25
41.5	16.7	91.5	17	204	17.16	340	19		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-214	.06	-14	.02	-13.91	.02	-13.9	.045	14.76	.06
41.5	.05								

Bank Sta: Left	Right	Coeff Contr.	Expan.
-13.91	14.76	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-214	-13.9	16.92	F
14.76	340	16.92	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins = 16.92
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd = .8
Max Low Cord =

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 115

INPUT
Description: Downstream face of Mystic Street Bridge
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-214	20	-173	19	-114.5	18	-64.5	17	-35	16
-14	14	-13.91	13.05	-13.9	12.21	-12.9	12.21	-10.32	10.92
-10.32	8.6	8.43	8.6	8.43	10.6	11.01	10.6	13.76	12.05
14.76	12.05	14.76	13.05	14.76	14	17.1	15	23.5	16.25
41.5	16.7	91.5	17	204	17.16	340	19		

Manning's n Values num= 6

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-214	.06	-14	.02	-13.91	.02	-13.9	.045	14.76	.06
41.5	.05								

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-13.91	14.76	45	40	30	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
-214	-13.9	16.92	F
14.76	340	16.92	F

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 75

INPUT
Description: 40 Downstream of Mystic St. Bridge
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-5.31	20	-5.3	11	-5.3	8.97	0	8.53	6.7	8.76
8.8	11	13	15.27	30	16	30	20		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-5.31	.02	-5.3	.04	8.8	.07	13	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-5.3	8.8	75	75	74	.1	.3

CROSS SECTION

RIVER: Mill Brook
REACH: Main RS: 0

INPUT
Description: Downstream End of Model (FEMA Cross-Section E)
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
-6.1	20	-6	10	-6	8.33	0	8.44	7	8.71
8.6	10	13.3	13.78	21.4	14	21.4	22.5		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
-6.1	.02	-6	.04	8.6	.07	13.3	.05

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
-6	8.6	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Mill Brook

Reach	River Sta.	n1	n2	n3	n4	n5	n6
Main	458	.06	.04	.07			
Main	384	.06	.045	.07			
Main	309	.06	.045	.06			
Main	244	.06	.045	.02	.06		
Main	179	.06	.02	.045	.06		
Main	140	Bridge					
Main	115	.06	.02	.02	.045	.06	.05
Main	75	.02	.04	.07	.05		
Main	0	.02	.04	.07	.05		

SUMMARY OF REACH LENGTHS

River: Mill Brook

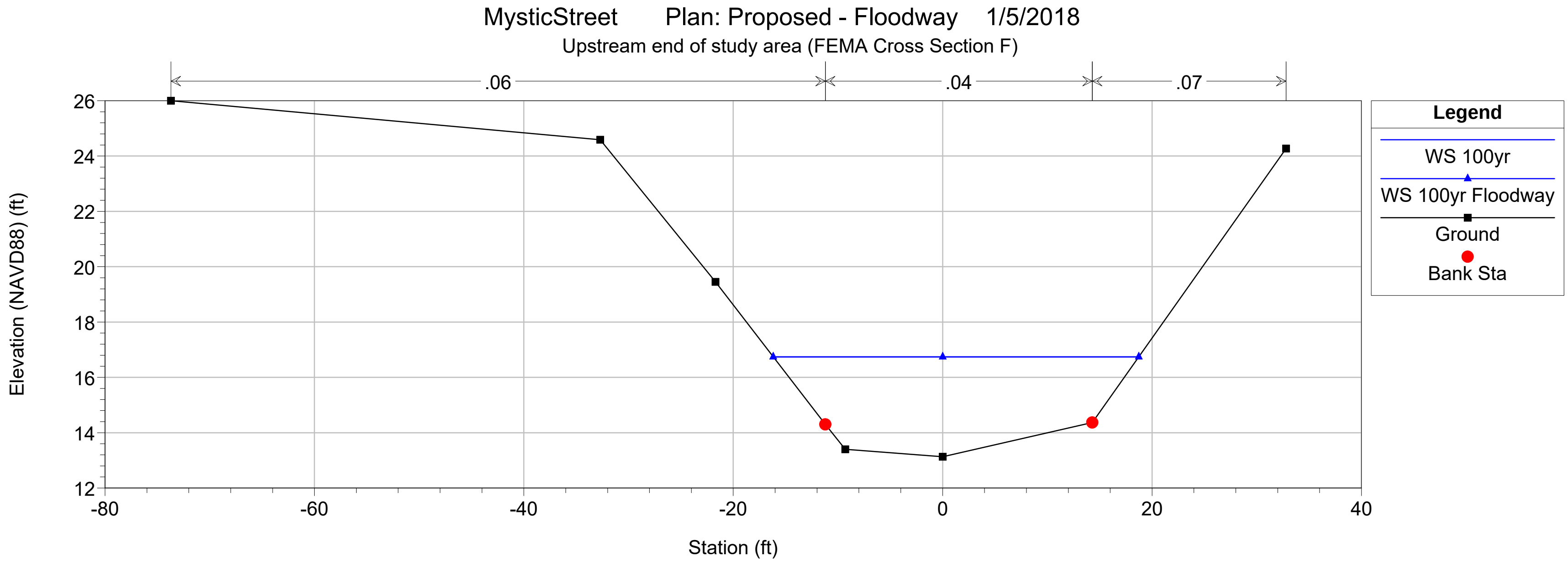
Reach	River Sta.	Left	Channel	Right
Main	458	77	74	70
Main	384	67	74	78
Main	309	66	65	65
Main	244	66	66	66
Main	179	63	63	66
Main	140	Bridge		
Main	115	45	40	30
Main	75	75	75	74
Main	0	0	0	0

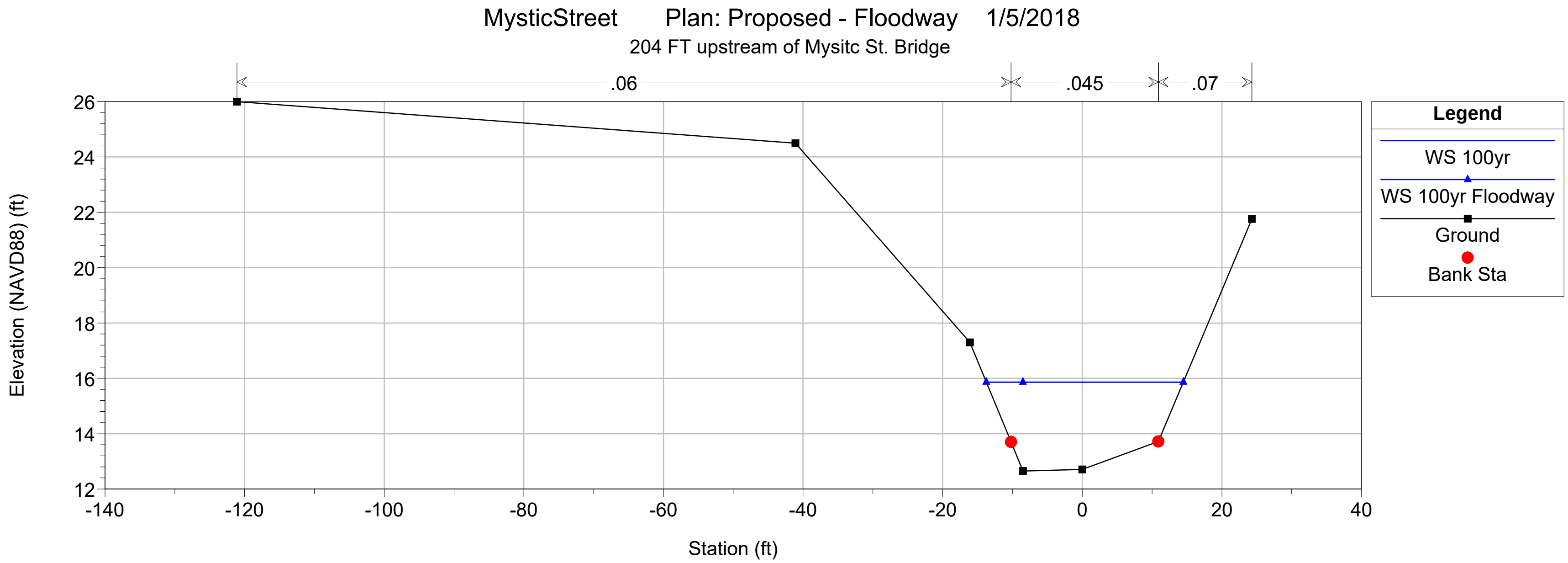
SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Mill Brook

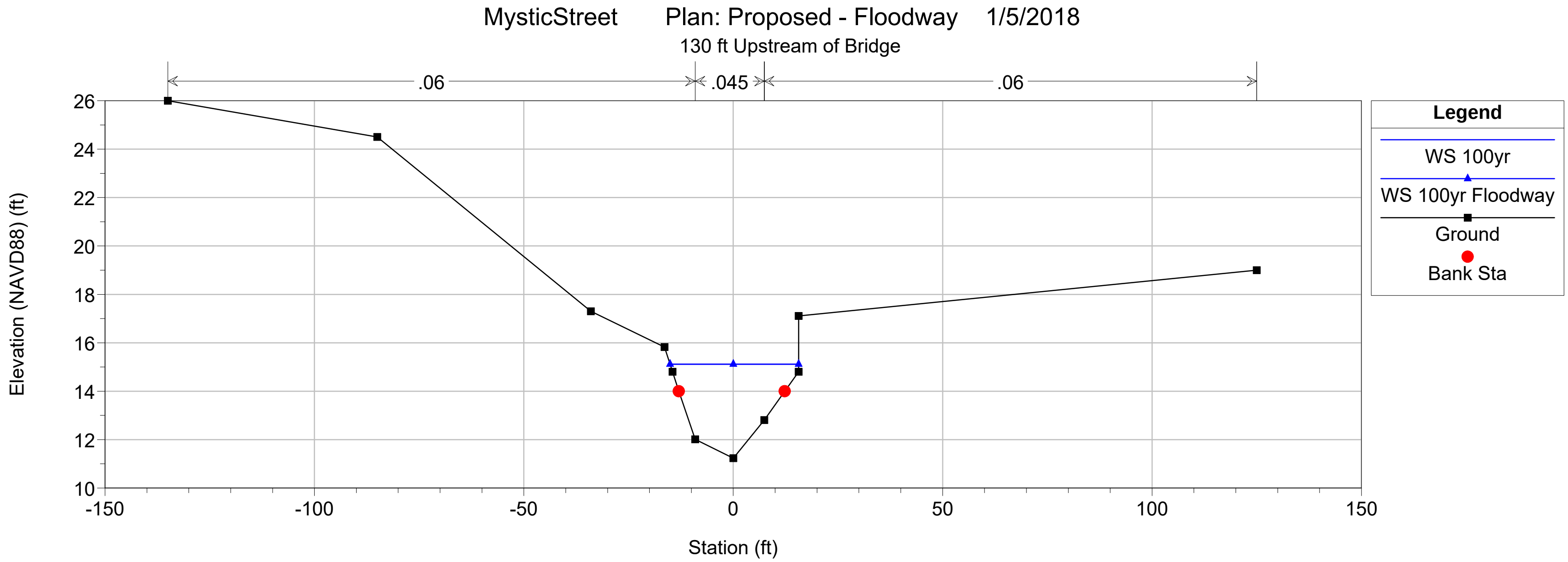
Reach	River Sta.	Contr.	Expan.
Main	458	.1	.3
Main	384	.1	.3
Main	309	.1	.3
Main	244	.1	.3
Main	179	.3	.5
Main	140	Bridge	
Main	115	.3	.5
Main	75	.1	.3
Main	0	.1	.3

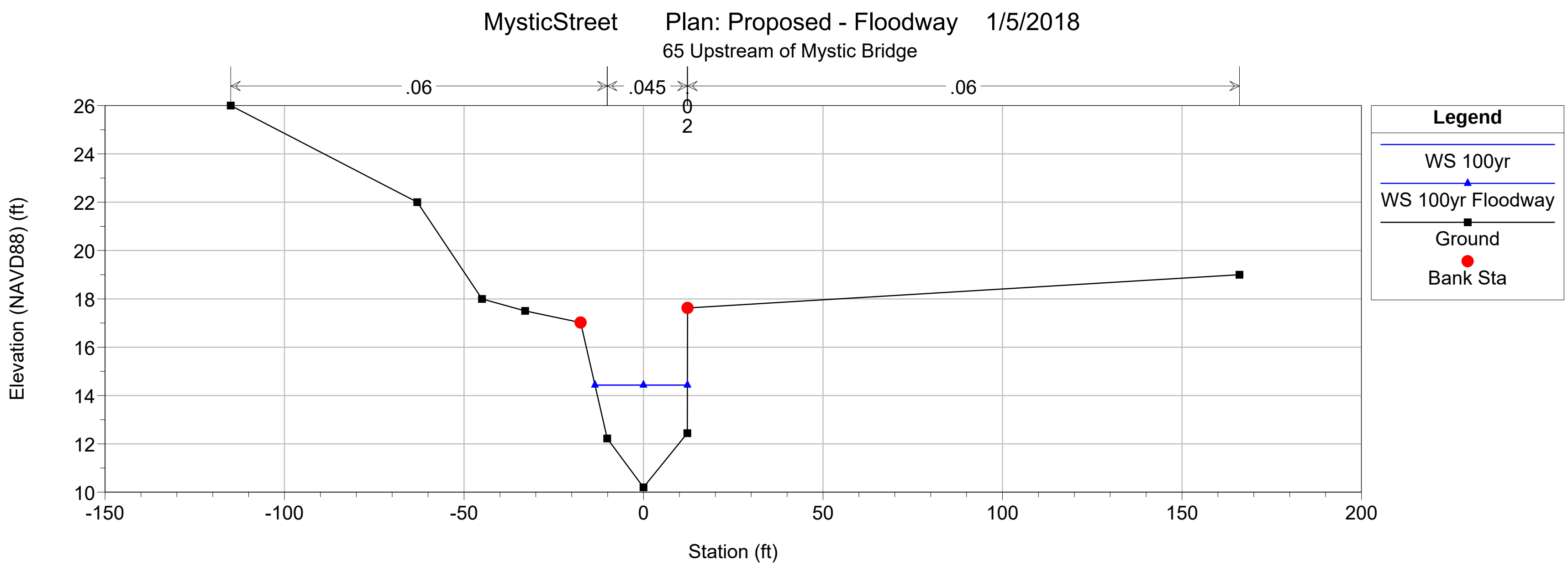
HEC-RAS Plan: Prop-Fldway River: Mill Brook Reach: Main

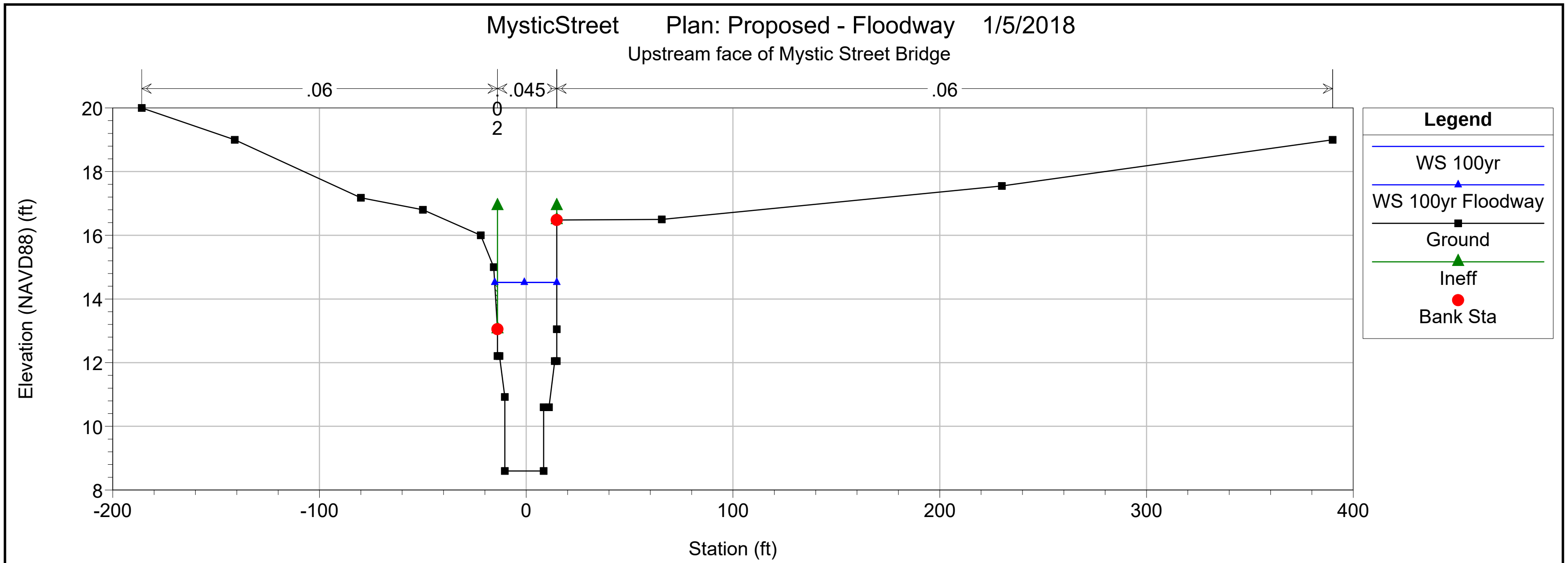
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	0	100yr	450.00	8.33	11.67	11.67	13.18	0.018836	9.88	46.91	16.70	0.99
Main	0	100yr Floodway	450.00	8.33	11.67	11.67	13.18	0.018836	9.88	46.91	16.70	0.99
Main	75	100yr	450.00	8.53	13.24	12.03	14.05	0.006866	7.23	64.17	16.31	0.61
Main	75	100yr Floodway	450.00	8.53	13.24	12.03	14.05	0.006869	7.24	64.16	16.30	0.61
Main	115	100yr	450.00	8.60	14.19	11.29	14.37	0.001822	3.39	132.75	31.16	0.28
Main	115	100yr Floodway	450.00	8.60	14.19	11.29	14.36	0.001822	3.39	132.75	31.15	0.28
Main	140		Bridge									
Main	179	100yr	450.00	8.60	14.52	11.29	14.68	0.001489	3.16	142.24	30.02	0.25
Main	179	100yr Floodway	450.00	8.60	14.52	11.29	14.68	0.001489	3.16	142.24	30.02	0.25
Main	244	100yr	450.00	10.20	14.43		15.00	0.009828	6.05	74.33	25.75	0.63
Main	244	100yr Floodway	450.00	10.20	14.43		15.00	0.009831	6.05	74.32	25.75	0.63
Main	309	100yr	450.00	11.23	15.11		15.71	0.011779	6.22	74.83	30.69	0.65
Main	309	100yr Floodway	450.00	11.23	15.11		15.71	0.011781	6.22	74.83	30.69	0.65
Main	384	100yr	450.00	12.65	15.86		16.63	0.011716	7.14	68.19	28.22	0.74
Main	384	100yr Floodway	450.00	12.65	15.86		16.63	0.011716	7.14	68.19	28.22	0.74
Main	458	100yr	450.00	13.13	16.74		17.17	0.004533	5.35	91.97	34.91	0.53
Main	458	100yr Floodway	450.00	13.13	16.74		17.17	0.004533	5.35	91.97	34.91	0.53


MysticStreet Plan: Proposed - Floodway 1/5/2018
Upstream end of study area (FEMA Cross Section F)
.06
.04
.07
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta
Elevation (NAVD88) (ft)
26
24
22
20
18
16
14
12
-80
-60
-40
-20
0
20
40
Station (ft)

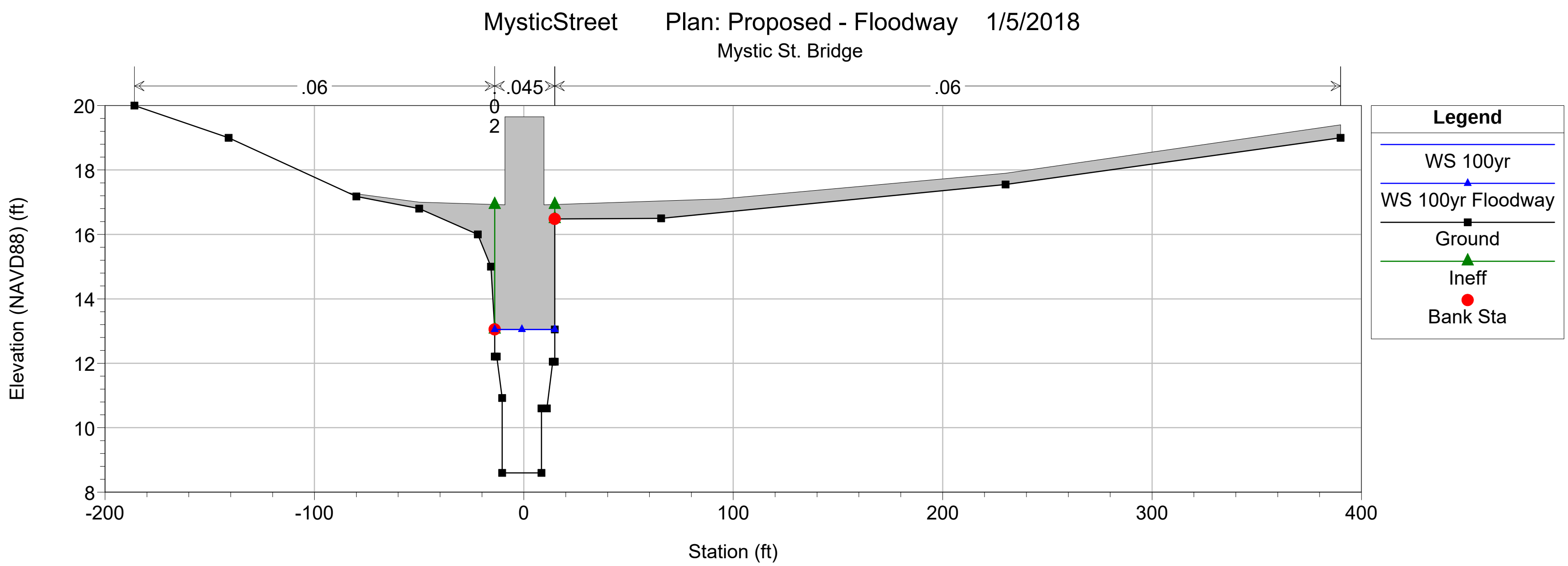

MysticStreet Plan: Proposed - Floodway 1/5/2018
204 FT upstream of Mysitc St. Bridge
.06
.045
.07
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta
Elevation (NAVD88) (ft)
26
24
22
20
18
16
14
12
-140
-120
-100
-80
-60
-40
-20
0
20
40
Station (ft)


MysticStreet Plan: Proposed - Floodway 1/5/2018
130 ft Upstream of Bridge
.06
.045
.06
Elevation (NAVD88) (ft)
Station (ft)
26
24
22
20
18
16
14
12
10
-150
-100
-50
0
50
100
150
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta

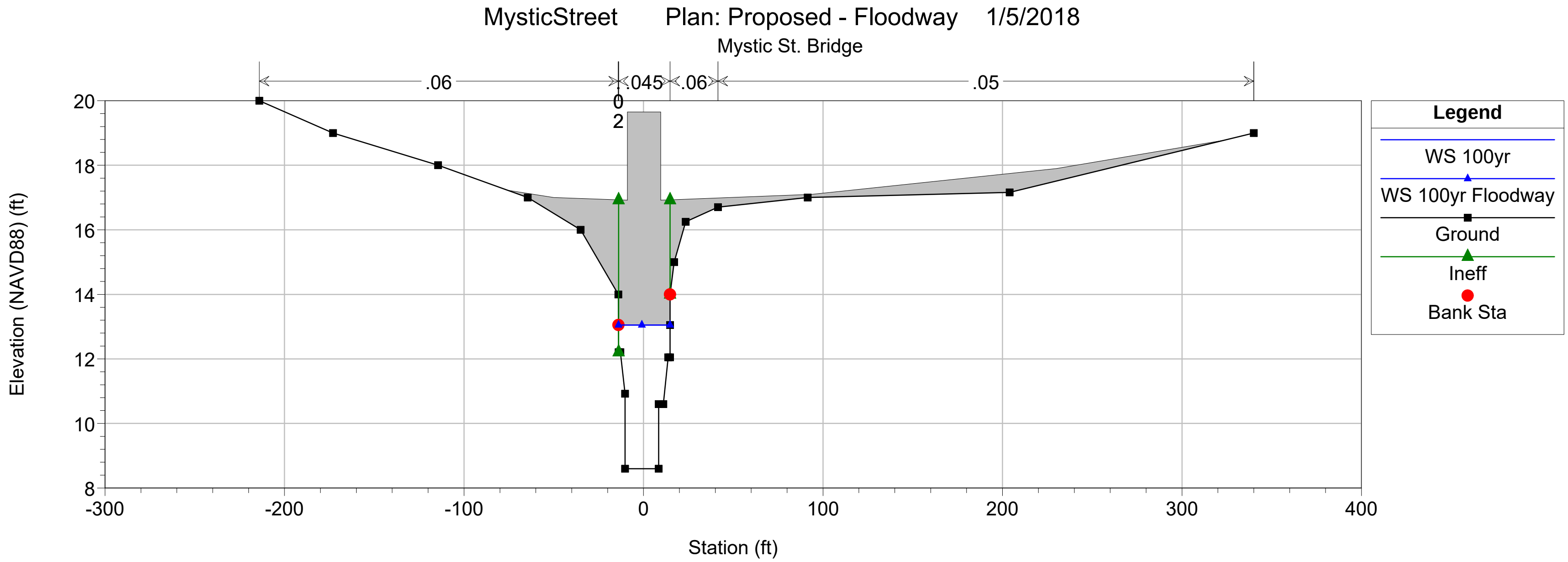

MysticStreet Plan: Proposed - Floodway 1/5/2018
65 Upstream of Mystic Bridge
.06
.045
.06
0
2
Elevation (NAVD88) (ft)
Station (ft)
26
24
22
20
18
16
14
12
10
-150
-100
-50
0
50
100
150
200
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta

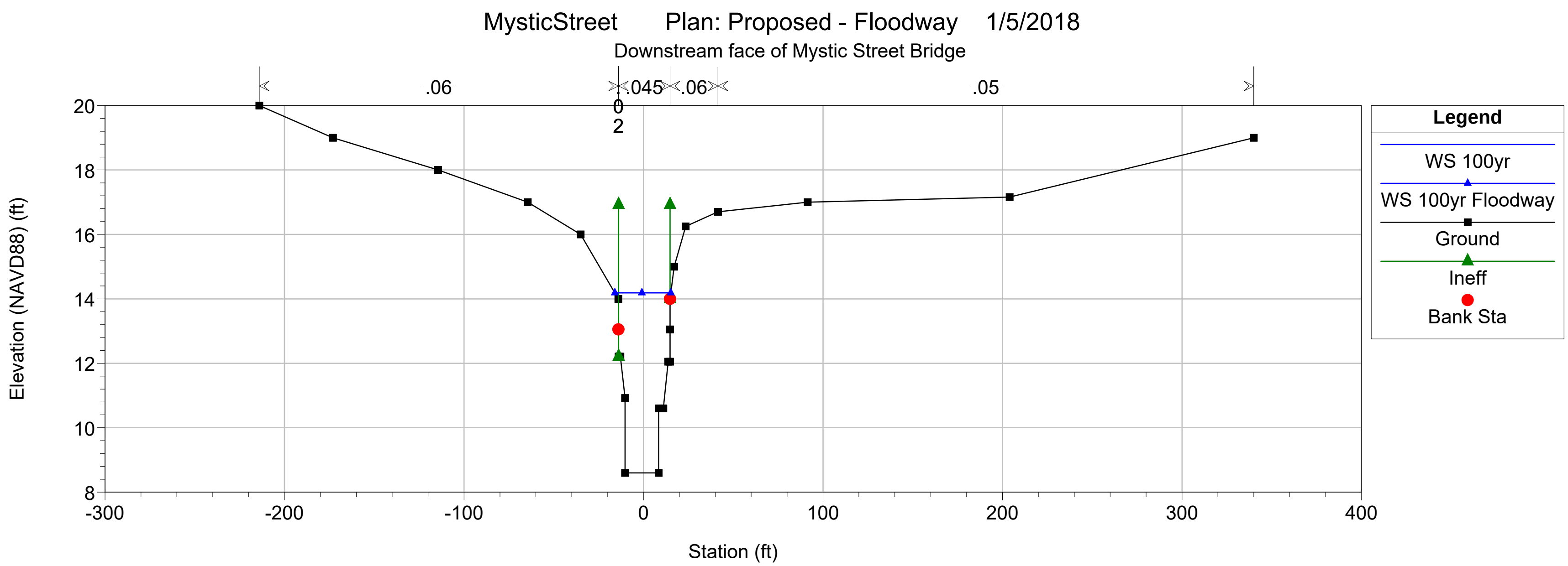


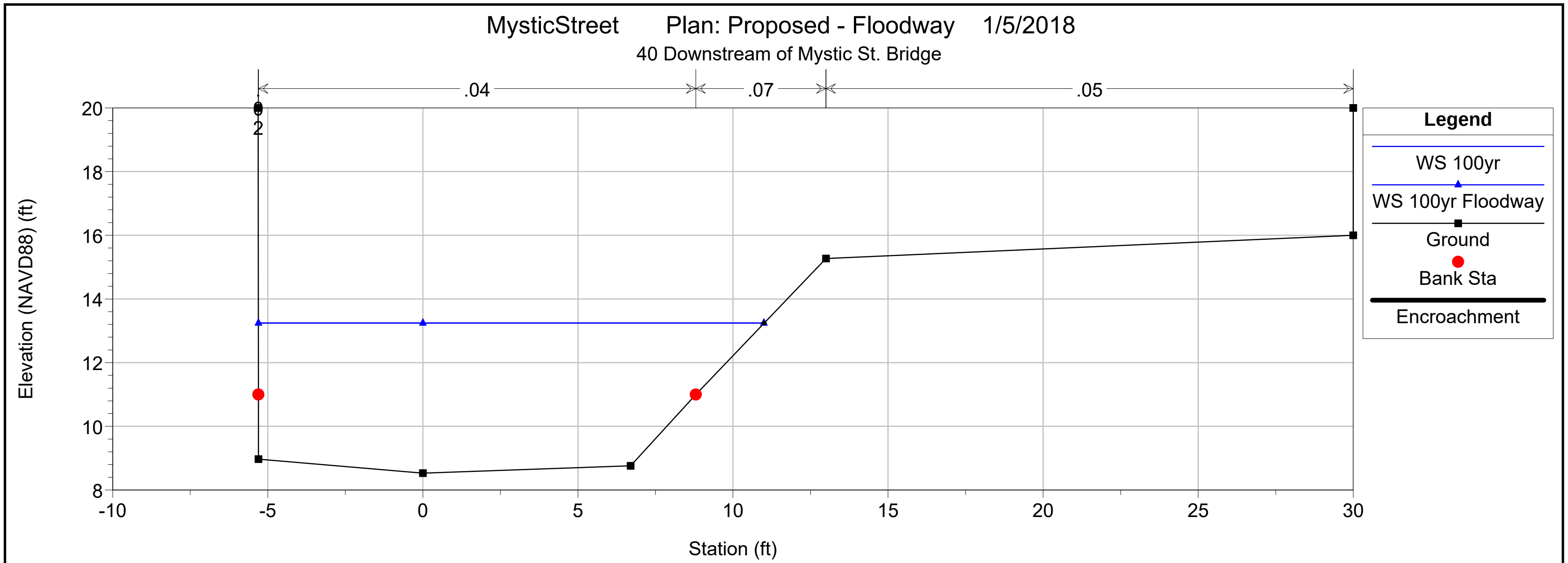
MysticStreet Plan: Proposed - Floodway 1/5/2018
Upstream face of Mystic Street Bridge
.06
.045
.06
0
2
Elevation (NAVD88) (ft)
Station (ft)
20
18
16
14
12
10
8
-200
-100
0
100
200
300
400
Legend
WS 100yr
WS 100yr Floodway
Ground
Ineff
Bank Sta

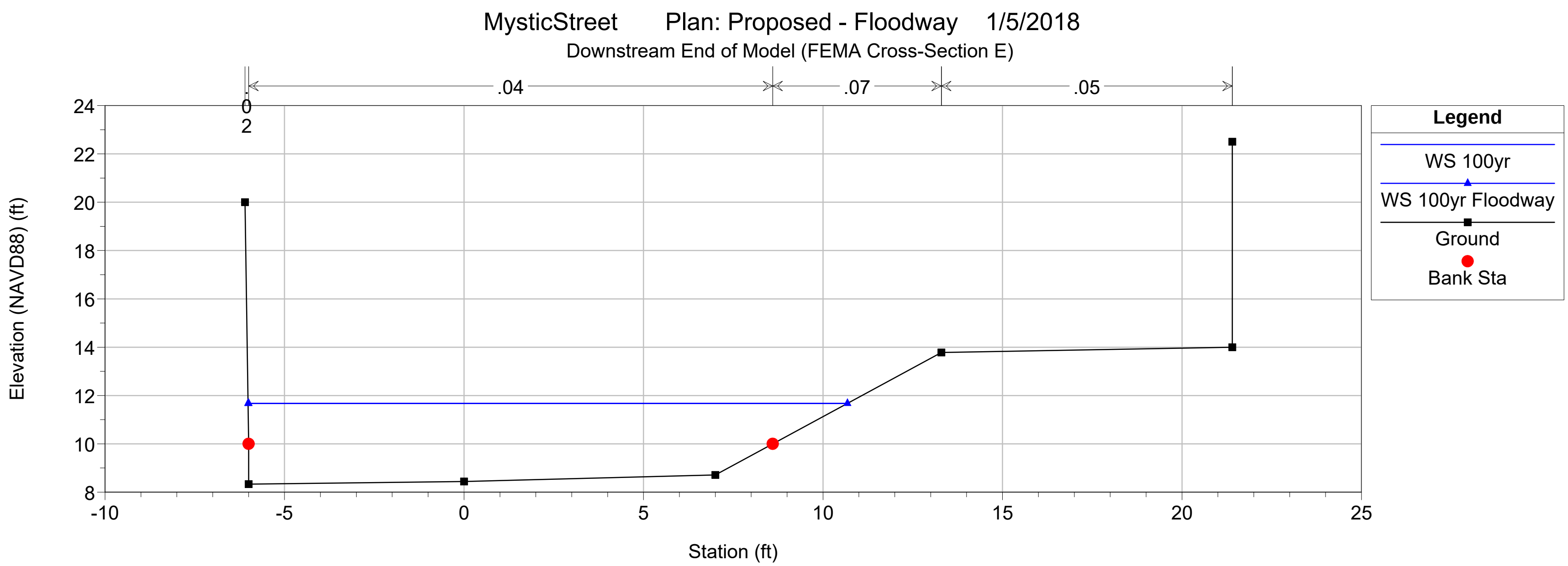


MysticStreet Plan: Proposed - Floodway 1/5/2018
Mystic St. Bridge
.06
.045
.06
0
2
Elevation (NAVD88) (ft)
Station (ft)
20
18
16
14
12
10
8
-200
-100
0
100
200
300
400
Legend
WS 100yr
WS 100yr Floodway
Ground
Ineff
Bank Sta


MysticStreet Plan: Proposed - Floodway 1/5/2018
Mystic St. Bridge
.06
.045
.06
.05
0
2
Elevation (NAVD88) (ft)
Station (ft)
20
18
16
14
12
10
8
-300
-200
-100
0
100
200
300
400
Legend
WS 100yr
WS 100yr Floodway
Ground
Ineff
Bank Sta


MysticStreet Plan: Proposed - Floodway 1/5/2018
Downstream face of Mystic Street Bridge
.06
.045
.06
.05
0
2
Elevation (NAVD88) (ft)
Station (ft)
20
18
16
14
12
10
8
-300
-200
-100
0
100
200
300
400
Legend
WS 100yr
WS 100yr Floodway
Ground
Ineff
Bank Sta


MysticStreet Plan: Proposed - Floodway 1/5/2018
40 Downstream of Mystic St. Bridge
.04
.07
.05
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta
Encroachment


MysticStreet Plan: Proposed - Floodway 1/5/2018
Downstream End of Model (FEMA Cross-Section E)
.04
.07
.05
Elevation (NAVD88) (ft)
Station (ft)
Legend
WS 100yr
WS 100yr Floodway
Ground
Bank Sta

APPENDIX F

Scour Computations

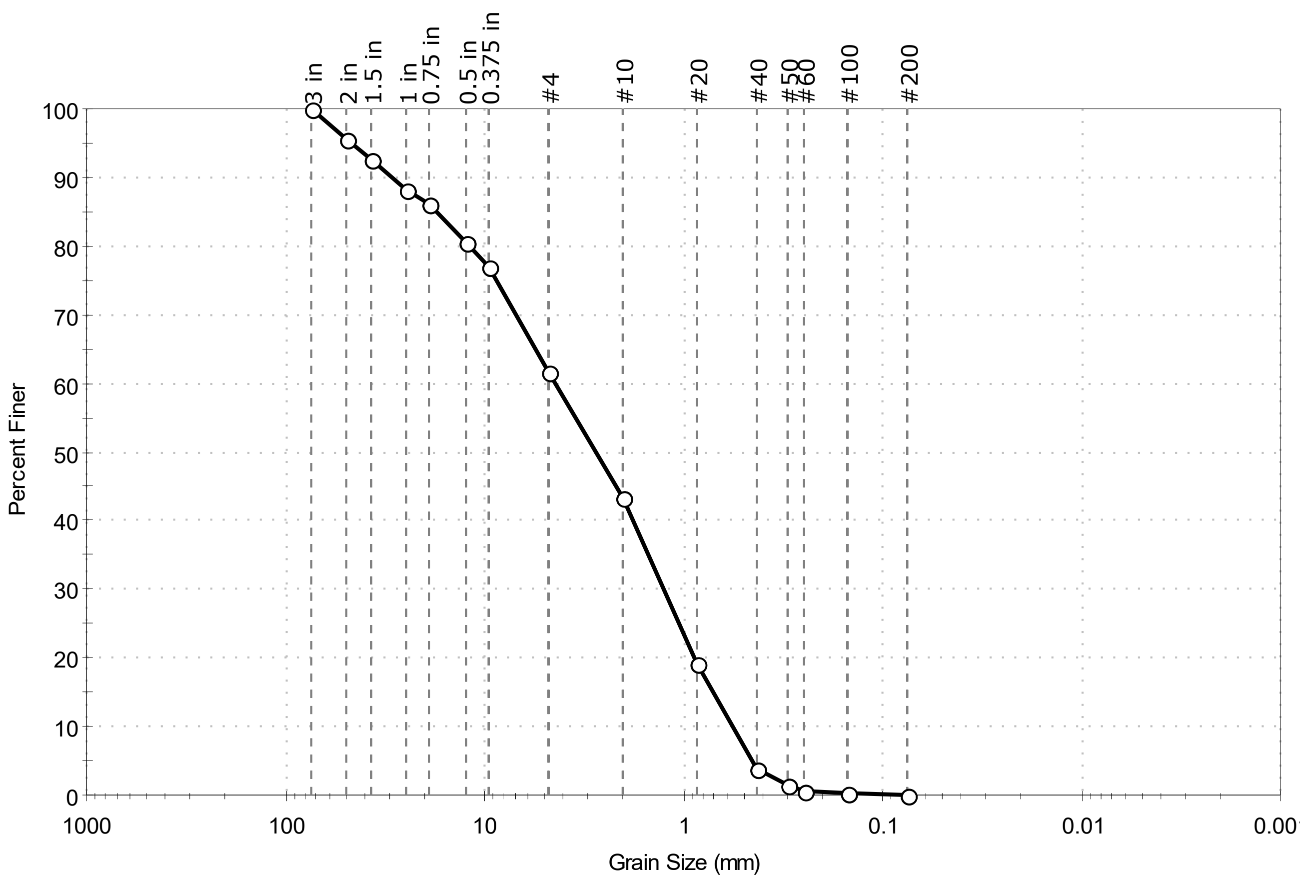
Client:	Weston & Sampson Engineers		
Project:	Mystic St. Bridge		
Location:	Arlington, MA	Project No:	GTX-306702
Boring ID: ---	Sample Type: bucket	Tested By:	jbr
Sample ID: Stream Bed	Test Date: 07/13/17	Checked By:	emm
Depth : ---	Test Id: 417101		

Test Comment: ---

Visual Description: Moist, brown sand with gravel

Sample Comment: ---

Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	38.4	61.5	0.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	96		
1.5 in	37.50	93		
1 in	25.00	88		
0.75 in	19.00	86		
0.5 in	12.50	80		
0.375 in	9.50	77		
#4	4.75	62		
#10	2.00	43		
#20	0.85	19		
#40	0.42	4		
#50	0.30	2		
#60	0.25	1		
#100	0.15	0		
#200	0.075	0.1		

Coefficients

D_{85} =17.3671 mm D_{30} =1.2452 mm

D_{60} =4.3966 mm D_{15} =0.7031 mm

D_{50} =2.7410 mm D_{10} =0.5626 mm

C_u =7.815 C_c =0.627

Classification

ASTM   Poorly graded sand with gravel (SP)

AASHTO   Stone Fragments, Gravel and Sand (A-1-a (1))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Abutment Scour Summary- Proposed Mystic Street Bridge
Mystic Street over Mill Brook, Arlington
January 2, 2017
Scour Estimates based on FHWA's HEC-18 (2012)

Abutment #1
Northerly Abutment
Left Abutment looking Downstream

Discharge Frequency (years)	HEC-18 Scour Depth (feet) Long-Term	Contraction	Pressure Flow (Vertical)	Amended Abutment	Total	NCHRP 24-20 Total Scour Depth (feet)	Recommended Total Scour Method	Recommended Total Scour Depth (feet)
10	0.0	0.00	N/A	0.00	0.00	0.00	NCHRP 24-20	0.00
50	0.0	N/A	0.00	0.45	0.45	N/A	HEC-18	0.45
100	0.0	N/A	0.00	0.85	0.85	N/A	HEC-18	0.85
200	0.0	N/A	0.36	1.24	1.60	N/A	HEC-18	1.60

Assumed Ground Elevation at Base of Abutment =	8.60	feet (NAVD88)	minimum thalweg elevation at downstream side
Foundation:	Piles		
Abutment, Top of Footing Elevation =	11.21	feet (NAVD88)	(Assumed Foundation)
Abutment, Bottom of Footing Elevation =	11.21	feet (NAVD88)	(Assumed Foundation)
Assumed Top of Bedrock Elevation =	-18.79	feet (NAVD88)	Competent rock not found

Discharge Frequency (years)	Long-Term + Contraction Scour* Elevation (feet)	Foundation Design	Total Scour Computed Scour Elevation (feet)	Computed Elevation Relative to Bedrock (feet)		Actual Scour Elevation (feet)	Foundation Design
10	8.60	Below Top of Footing, NG	8.60	+27.39	←Total Scour above Top of Rock	8.60	Design for Unbraced Length
50	8.60	Below Top of Footing, NG	8.15	+26.94	←Total Scour above Top of Rock	8.15	Design for Unbraced Length
100	8.60	Below Top of Footing, NG	7.75	+26.54	←Total Scour above Top of Rock	7.75	Design for Unbraced Length
200	8.60	Below Top of Footing, NG	7.00	+25.79	←Total Scour above Top of Rock	7.00	Design for Unbraced Length

*Assumed to be horizontal contraction scour if pressure flow conditions

Abutment Scour Summary- Proposed Mystic Street Bridge
Mystic Street over Mill Brook, Arlington
January 2, 2017
Scour Estimates based on FHWA's HEC-18 (2012)

Abutment #2
Southerly Abutment
Right Abutment looking Downstream

Discharge Frequency (years)	HEC-18 Scour Depth (feet)					NCHRP 24-20 Total Scour Depth (feet)	Recommended Total Scour Method	Recommended Total Scour Depth (feet)
	Long-Term	Contraction	Pressure Flow (Vertical)	Amended Abutment	Total			
10	0.0	0.00	N/A	0.00	0.00	0.00	HEC-18	0.00
50	0.0	N/A	0.00	0.83	0.83	N/A	HEC-18	0.83
100	0.0	N/A	0.00	1.56	1.56	N/A	HEC-18	1.56
200	0.0	N/A	0.36	2.04	2.40	N/A	HEC-18	2.40

Assumed Ground Elevation at Base of Abutment = 8.60 feet (NAVD88) minimum thalweg elevation at downstream side
Foundation: Piles
Abutment, Top of Footing Elevation = 11.05 feet (NAVD88) (Assumed Foundation)
Abutment, Bottom of Footing Elevation = 11.05 feet (NAVD88) (Assumed Foundation)
Assumed Top of Bedrock Elevation = -18.95 feet (NAVD88) Competent rock not found

Discharge Frequency (years)	Long-Term + Contraction Scour*		Total Scour				
	Elevation (feet)	Foundation Design	Computed Scour Elevation (feet)	Computed Elevation Relative to Bedrock (feet)		Actual Scour Elevation (feet)	Foundation Design
10	8.60	Below Top of Footing, NG	8.60	+27.55	←Total Scour above Top of Rock	8.60	Design for Unbraced Length
50	8.60	Below Top of Footing, NG	7.77	+26.72	←Total Scour above Top of Rock	7.77	Design for Unbraced Length
100	8.60	Below Top of Footing, NG	7.04	+25.99	←Total Scour above Top of Rock	7.04	Design for Unbraced Length
200	8.60	Below Top of Footing, NG	6.20	+25.15	←Total Scour above Top of Rock	6.20	Design for Unbraced Length

*Assumed to be horizontal contraction scour if pressure flow conditions

Contraction Scour- Proposed Mystic Street Bridge
Mystic Street over Mill Brook, Arlington
January 2, 2017
Scour Estimates based on FHWA's HEC-18 (2012)

Note- Section, equation, table and figure references are to HEC-18 (2012)

Structure Type: Bridge → If No Pressure Flow, Compute Contraction Scour using Live-Bed (Eq. 6.2) and Clear Water (Eq. 6.4) Equations

Pressure Flow:

Discharge Frequency (years)	Pressure Flow?	Contraction/Pressure Flow Vertical Scour:
10	No	Compute Contraction Scour, Sections 6.3 and 6.4
50	Yes	Compute Pressure Flow Vertical Scour, Section 6.10
100	Yes	Compute Pressure Flow Vertical Scour, Section 6.10
200	Yes	Compute Pressure Flow Vertical Scour, Section 6.10

Determination of Critical Velocity:

If $V_1 < V_c$, then clear-water contraction scour occurs.

If $V_1 > V_c$, then live-bed contraction scour occurs.

Variable		Discharge Frequency (years)				Notes
		10	50	100	200	
y_1	Channel Average Depth at Approach Section, feet	1.58	2.34	2.82	3.41	From HEC-RAS, Section 309
D_{50}	Size of Bed Material, mm	2.74	2.74	2.74	2.74	
V_c	Critical Velocity, fps	2.51	2.68	2.76	2.85	Equation 6.1
V_1	Channel Velocity in the Approach Section, fps	3.94	5.21	6.22	6.09	From HEC-RAS, Section 309
	Live Bed or Clear Water Contraction Scour?	Live-Bed	Live-Bed	Live-Bed	Live-Bed	

Live-Bed Contraction Scour (HEC-18, Section 6.3- Modified 1960 Laursen's Equation):

Variable		Discharge Frequency (years)				Notes
		10	50	100	200	
y_1	Channel Average Depth at Approach Section, feet	1.58	2.34	2.82	3.41	From HEC-RAS, Section 309
y_o	Channel Average Depth Inside the Bridge Opening, feet	3.22	4.45	4.45	4.45	From HEC-RAS, Section 140 BR U
Q_1	Channel Flow at the Approach Section, cfs	150.00	310.00	450.00	540.00	From HEC-RAS, Section 309
Q_2	Channel Flow through the Bridge Opening, cfs	150.00	310.00	450.00	540.00	Flow through Bridge, excluding Weir Flow
W_1	Channel Top Width at the Approach Section, feet	24.04	25.30	25.30	25.30	From HEC-RAS, Section 309
W_2	Channel Top Width Inside the Bridge Opening, feet	28.66	28.66	28.66	28.66	Clear span length
S_1	Energy Gradeline Slope at Approach Section, ft/ft	0.010053	0.010601	0.011178	0.008766	From HEC-RAS, Section 309
ω	Fall Velocity, m/s	0.240	0.240	0.240	0.240	Figure 6.8
V_*	Shear Velocity in Upstream Section, fps $[(gy_1S_1)^{½}]$	0.72	0.89	1.01	0.98	
V_*/ω	Ratio of Shear Velocity to Fall Velocity	0.91	1.14	1.28	1.25	
k_1	Mode of Bed Material Transport Exponent	0.64	0.64	0.64	0.64	See table on page 6.10
y_2	Average Depth in the Contracted Section, feet	1.41	2.16	2.60	3.15	Equation 6.2
y_s	Live-Bed Contraction Scour Depth, feet =	0.00	Pressure Flow	Pressure Flow	Pressure Flow	(Equation 6.3), N/A if pressure flow
		0.00	0.00	0.00	0.00	

Clear-Water Contraction Scour (HEC-18, Section 6.4- Laursen 1963):

Variable		Discharge Frequency (years)				Notes
		10	50	100	200	
y_o	Channel Average Depth Inside the Bridge Opening, feet	3.22	4.45	4.45	4.45	From HEC-RAS, Section 1036 BR U
Q_2	Channel Flow through the Bridge Opening, cfs	150.00	310.00	450.00	540.00	Flow through Bridge, no overtopping
W_2	Channel Top Width Inside the Bridge Opening, feet	28.66	28.66	28.66	28.66	Clear span length
D_m	Diameter of Smallest Nontransportable Particle, feet	0.0112	0.0112	0.0112	0.0112	$1.25D_{50}$
y_2	Average Depth in the Contracted Section, feet	1.85	3.45	4.75	5.55	Equation 6.4
y_s	Clear-Water Contraction Scour Depth, feet =	N/A	Pressure Flow	Pressure Flow	Pressure Flow	(Equation 6.5), N/A if pressure flow
		N/A	N/A	N/A	N/A	

Pressure Flow Vertical Contraction Scour- Proposed Mystic Street Bridge
Mystic Street over Mill Brook, Arlington
January 2, 2017
Scour Estimates based on FHWA's HEC-18 (2012)

Note- Section, equation and table references are to HEC-18 (2012)

Pressure Flow:

Discharge Frequency (years)	Pressure Flow?	Pressure Flow Vertical Contraction Scour:
10	No	No Pressure Flow Vertical Contraction Scour
50	Yes	Estimate Pressure Flow Vertical Contraction Scour
100	Yes	Estimate Pressure Flow Vertical Contraction Scour
200	Yes	Estimate Pressure Flow Vertical Contraction Scour

Contraction Scour:

Discharge Frequency (years)	Clear-Water or Live-Bed?	Contraction Scour Equation:
10	Live-Bed	N/A
50	Live-Bed	Use Equation 6.2
100	Live-Bed	Use Equation 6.2
200	Live-Bed	Use Equation 6.2

Bridge Deck Overtopping Flows:

Discharge Frequency (years)	Bridge Deck Overtopping?	Disregard Deck Overtopping Flows:
10	No	N/A
50	No	N/A
100	No	N/A
200	No	N/A

For Bridge Overtopping Conditions:

Variable		Discharge Frequency (years) 10	50	100	200	Notes
Q_2	Channel Flow through the Bridge Opening, cfs	150.00	310.00	450.00	540.00	Flow through Bridge, excluding Weir Flow
Q_1	Channel Flow at the Approach Section, cfs	150.00	310.00	450.00	540.00	From HEC-RAS, Section 309
h_b	Vertical Size of Bridge Opening Prior to Scour, feet	3.22	4.45	4.45	4.45	= y_0, Channel Ave. Depth Inside Bridge Opening
T	Height of Superstructure Obstruction, feet	4.03	4.20	4.03	4.20	Includes girders, deck and parapet
	Computed Flood Elevation, feet	13.79	14.64	15.11	15.70	From HEC-RAS, Section 309
	Low Chord Elevation, feet	13.05	13.05	13.05	13.05	Maximum elevation, at northerly abutment
h_{ue}	Effective Upstream Channel Flow Depth, feet	3.96	6.04	6.51	7.10	For Deck Overtopping, $h_{ue} = h_b + T$
h_u	Upstream Channel Flow Depth, feet	3.96	6.04	6.51	7.10	
Q_{ue}	Effective Channel Discharge, cfs	150.00	310.00	450.00	540.00	Equation 6.15 for Deck Overtopping

Separation Zone Thickness

Variable		Discharge Frequency (years) 10	50	100	200	Notes
h_b	Vertical Size of Bridge Opening Prior to Scour, feet	3.22	4.45	4.45	4.45	= y_0, Channel Ave. Depth Inside Bridge Opening
h_u	Upstream Channel Flow Depth, feet	3.96	6.04	6.51	7.10	
h_t	Distance from Water Surface to Low Chord, feet	0.74	1.59	2.06	2.65	= $h_u - h_b$
T	Height of Superstructure Obstruction, feet	4.03	4.20	4.03	4.20	Includes girders, deck and parapet
h_w	Weir Flow Height, feet	0.00	0.00	0.00	0.00	= h_t - T for $h_t > T$ = 0 for $h_t \leq T$
t	Separation Zone Thickness, feet		1.60	1.64	1.66	Equation 6.16

For Live-Bed Contraction Scour Conditions (HEC-18, Section 6.3- Modified 1960 Laursen's Equation):

Variable		Discharge Frequency (years) 10	50	100	200	Notes
y_1	Channel Average Depth at Approach Section, feet	1.58	2.34	2.82	3.41	Modify for Deck Overtopping Conditions
y_o	Channel Average Depth Inside the Bridge Opening, feet	3.22	4.45	4.45	4.45	From HEC-RAS, Section 140 BR U
Q_1	Channel Flow at the Approach Section, cfs	150.00	310.00	450.00	540.00	Modify for Deck Overtopping Conditions
Q_2	Channel Flow through the Bridge Opening, cfs	150.00	310.00	450.00	540.00	Flow through Bridge, excluding Weir Flow
W_1	Channel Top Width at the Approach Section, feet	24.04	25.30	25.30	25.30	From HEC-RAS, Section 309
W_2	Channel Top Width Inside the Bridge Opening, feet	28.66	28.66	28.66	28.66	Clear span length
k_1	Mode of Bed Material Transport Exponent	0.64	0.64	0.64	0.64	See table on page 6.10
y_2	Average Depth in the Contracted Section, feet	1.41	2.16	2.60	3.15	Equation 6.2
y_s	Live-Bed Pressure Flow Vertical Scour, feet =	N/A	0.00	0.00	0.36	(Equation 6.14)

For Clear-Water Contraction Scour Conditions (HEC-18, Section 6.4- Laursen 1963):

Variable		Discharge Frequency (years) 10	50	100	200	Notes
y_o	Channel Average Depth Inside the Bridge Opening, feet	3.22	4.45	4.45	4.45	From HEC-RAS, Section 140 BR U
Q_2	Channel Flow through the Bridge Opening, cfs	150.00	310.00	450.00	540.00	Flow through Bridge, excluding Weir Flow
W_2	Channel Top Width Inside the Bridge Opening, feet	28.66	28.66	28.66	28.66	Clear span length
D_m	Diameter of Smallest Nontransportable Particle, feet	0.0112	0.0112	0.0112	0.0112	$1.25D_{50}$
y_2	Average Depth in the Contracted Section, feet	1.85	3.45	4.75	5.55	Equation 6.4
y_s	Clear-Water Pressure Flow Vertical Scour, feet =	N/A	N/A	N/A	N/A	(Equation 6.14)

Amended Froehlich's Abutment Scour- Proposed Mystic Street Bridge
Mystic Street over Mill Brook, Arlington
January 2, 2017
Scour Estimates based on FHWA's HEC-18 (2012)

Note- Table references are to HEC-18 (2012)

Abutment #1
Northerly Abutment
Left Abutment looking Downstream

Variable		Discharge Frequency (years)				Notes
		10	50	100	200	
	Abutment Shape	Vertical-Wall w/ Wing Walls	Vertical-Wall w/ Wing Walls	Vertical-Wall w/ Wing Walls	Vertical-Wall w/ Wing Walls	
K_1	Coefficient for Abutment Shape (Table 8.1)	0.82	0.82	0.82	0.82	
Θ	Abutment Skew (Θ<90 if Embankment Points Downstream, Θ>90 if Embankment Points Upstream)	15	15	15	15	
K_2	Coefficient for Angle of Embankment to Flow	0.79	0.79	0.79	0.79	$(\Theta / 90)^{0.13}$
L'	Length of Abutment Projected Normal to Flow, feet	0.00	1.19	2.09	3.18	From HEC-RAS, Section 309
Q_e	Flow Obstructed by Embankment at Approach Section, cfs	0.00	0.42	1.95	5.21	From HEC-RAS, Section 309
A_e	Flow Area Obstructed by Embankment at Approach Section, ft^2	0.00	0.38	1.16	2.72	From HEC-RAS, Section 309
V_e	Vel. of Flow Obstructed by Embankment at Approach Section, cfs	N/A	1.11	1.68	1.92	Q_e / A_e
Fr	Froude Number at Approach Section	0.00	0.34	0.40	0.37	$Ve / (gy_a)^{0.5}$
y_a	Average Depth of Flow on Floodplain at Approach Section, feet	0.00	0.32	0.56	0.85	From HEC-RAS, Section 309
y_s	Amended Abutment Scour Depth, feet =	0.00	0.45	0.85	1.24	(ConnDOT 2000 *Drainage Manual* , page 9.B-2)

Table 8.1. Abutment Shape Coefficients.

Description	K_1
Vertical-wall abutment	1.00
Vertical-wall abutment with wing walls	0.82
Spill-through abutment	0.55

Amended Froehlich's Abutment Scour- Proposed Mystic Street Bridge
Mystic Street over Mill Brook, Arlington
January 2, 2017
Scour Estimates based on FHWA's HEC-18 (2012)

Note- Table references are to HEC-18 (2012)

Abutment #2
Southerly Abutment
Right Abutment looking Downstream

Variable		Discharge Frequency (years)				Notes
		10	50	100	200	
	Abutment Shape	Vertical-Wall w/ Wing Walls	Vertical-Wall w/ Wing Walls	Vertical-Wall w/ Wing Walls	Vertical-Wall w/ Wing Walls	
K_1	Coefficient for Abutment Shape (Table 8.1)	0.82	0.82	0.82	0.82	
Θ	Abutment Skew (Θ<90 if Embankment Points Downstream, Θ>90 if Embankment Points Upstream)	105	105	105	105	
K_2	Coefficient for Angle of Embankment to Flow	1.02	1.02	1.02	1.02	$(\Theta / 90)^{0.13}$
L'	Length of Abutment Projected Normal to Flow, feet	0.00	2.63	3.30	3.30	From HEC-RAS, Section 309
Q_e	Flow Obstructed by Embankment at Approach Section, cfs	0.00	0.98	4.69	9.99	From HEC-RAS, Section 309
A_e	Flow Area Obstructed by Embankment at Approach Section, ft^2	0.00	0.84	2.36	4.30	From HEC-RAS, Section 309
V_e	Vel. of Flow Obstructed by Embankment at Approach Section, cfs	N/A	1.17	1.99	2.32	Q_e / A_e
Fr	Froude Number at Approach Section	0.00	0.36	0.42	0.36	$Ve / (gy_a)^{0.5}$
y_a	Average Depth of Flow on Floodplain at Approach Section, feet	0.00	0.32	0.71	1.30	From HEC-RAS, Section 309
y_s	Amended Abutment Scour Depth, feet =	0.00	0.83	1.56	2.04	(ConnDOT 2000 *Drainage Manual* , page 9.B-2)

NCHRP 24-20 Abutment Scour- Proposed Mystic Street Bridge
Mystic Street over Mill Brook, Arlington
January 2, 2017
Scour Estimates based on FHWA's HEC-18 (2012) and National Cooperative Highway Research Program's 24-20 Report (2010)

Notes- References are to HEC-18 (2012), Section 8.6.3
Method not applicable to pressure flow conditions.

Abutment #1
Northerly Abutment
Left Abutment looking Downstream

Variable		Discharge Frequency (years) 10	50	100	200	Notes
	Set-Back Length, feet	0.00	0.00	0.00	0.00	Assume negligible
	Average Channel Flow Depth, feet	3.22	4.45	4.45	4.45	From HEC-RAS, Section 140 BR U
SBR	Set-Back Ratio: (Set-Back Length)/(Ave. Channel Flow Depth)	0.0	0.0	0.0	0.0	If SBR<5, use average bridge velocity
		SBR<5	SBR<5	SBR<5	SBR<5	If SBR≥5, use overbank flow velocity
L'	Length of Abutment Projected Normal to Flow, feet	0.00	1.19	2.09	3.18	From HEC-RAS, Section 309
B_f	Width of Floodplain, feet	0.00	1.19	2.09	3.18	Assume L' and B_f Approximately Equal
L' / B_f	If ≥ 0.75, then Figure 8.7a, assume Live-Bed, use Equation 8.5 If < 0.75, then Figure 8.7b, assume Clear-Water, use Equation 8.6	1.00	1.00	1.00	1.00	
	Contraction Scour Calculation:	Live-Bed	Live-Bed	Live-Bed	Live-Bed	

Live-Bed Contraction Scour Calculation

Variable		Discharge Frequency (years) 10	50	100	200	Notes
y_1	Channel Average Depth at Approach Section, feet	1.58	2.34	2.82	3.41	From HEC-RAS, Section 309
Q_1	Channel Flow through the Approach Section, cfs	150.00	310.00	450.00	540.00	From HEC-RAS, Section 309
W_1	Channel Top Width at the Approach Section, feet	24.04	25.30	25.30	25.30	From HEC-RAS, Section 309
q_1	Unit Discharge at the Approach Section, ft^2/s	6.24	12.25	17.79	21.34	Q_1 / W_1
Q_2	Channel Flow through the Bridge Opening, cfs	150.00	310.00	450.00	540.00	Flow through Bridge, excluding Weir Flow
W_2	Channel Top Width Inside the Bridge Opening, feet	28.66	28.66	28.66	28.66	Clear span length
q_{2c}	Unit Discharge in the Constricted Opening, ft^2/s	5.23	10.82	15.70	18.84	Q_2 / W_2
q_{2c} / q_1		0.84	0.88	0.88	0.88	
α_A	Amplification Factor for Live-Bed Conditions	1.20	1.20	1.20	1.20	Wingwall Abutments (Figure 8.10)
y_c	Flow Depth including Live-Bed Contraction Scour, feet	1.36	2.10	2.53	3.06	Equation 8.5
y_{max}	Maximum Flow Depth resulting from Abutment Scour, feet	1.63	2.52	3.04	3.68	Equation 8.3
y_o	Channel Average Depth Inside the Bridge Opening, feet	3.22	4.45	4.45	4.45	From HEC-RAS, Section 140 BR U
y_s	Live-Bed Contraction Scour Depth, feet =	0.00	0.00	0.00	0.00	(Equation 8.4)
			N/A, Qpress	N/A, Qpress	N/A, Qpress	

Clear-Water Contraction Scour Calculation

Variable		Discharge Frequency (years) 10	50	100	200	Notes
D_{50}	Size of Bed Material, mm	2.74	2.74	2.74	2.74	
q_{2f}	Unit Discharge in the Constricted Opening, ft^2/s	5.23	10.82	15.70	18.84	Q_2 / W_2
q_1	Unit Discharge at the Approach Section, ft^2/s	6.24	12.25	17.79	21.34	
q_{2f} / q_1		0.84	0.88	0.88	0.88	
α_B	Amplification Factor for Clear-Water Conditions	1.00	1.00	1.00	1.00	Wingwall Abutments (Figure 8.12)
y_c	Flow Depth including Clear-Water Contraction Scour, feet	2.01	3.74	5.15	6.02	Equation 8.6
y_{max}	Maximum Flow Depth resulting from Abutment Scour, feet	2.01	3.74	5.15	6.02	Equation 8.3
y_o	Channel Average Depth Inside the Bridge Opening, feet	3.22	4.45	4.45	4.45	From HEC-RAS, Section 140 BR U
y_s	Clear-Water Contraction Scour Depth, feet =	N/A	N/A	N/A	N/A	(Equation 8.4)
			N/A, Qpress	N/A, Qpress	N/A, Qpress	

NCHRP 24-20 Abutment Scour- Proposed Mystic Street Bridge
Mystic Street over Mill Brook, Arlington
January 2, 2017
Scour Estimates based on FHWA's HEC-18 (2012) and National Cooperative Highway Research Program's 24-20 Report (2010)

Notes- References are to HEC-18 (2012), Section 8.6.3
Method not applicable to pressure flow conditions.

Abutment #2
Southerly Abutment
Right Abutment looking Downstream

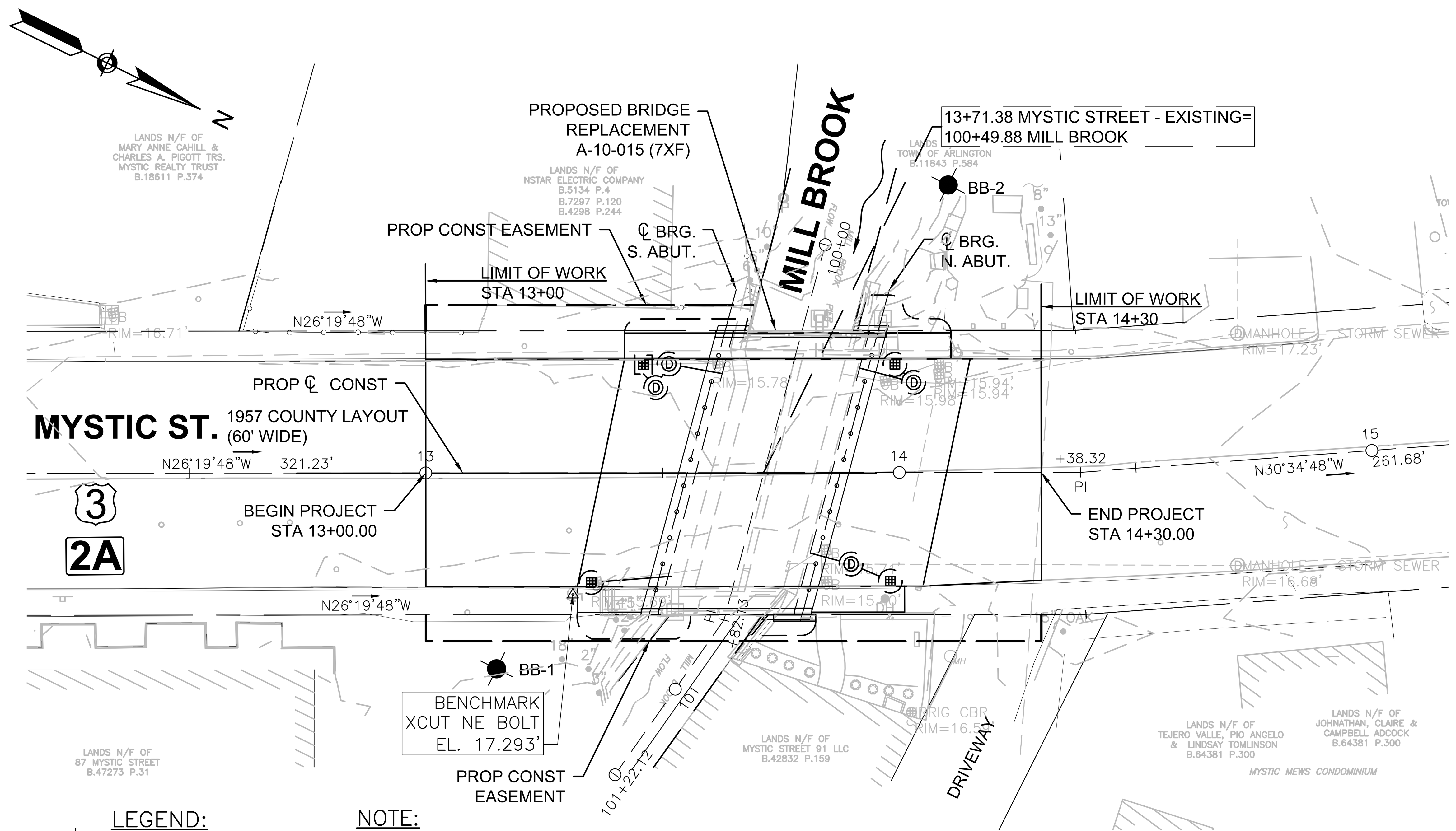
Variable		Discharge Frequency (years) 10	50	100	200	Notes
	Set-Back Length, feet	0.00	0.00	0.00	0.00	Assume negligible
	Average Channel Flow Depth, feet	3.22	4.45	4.45	4.45	From HEC-RAS, Section 340 BR U
SBR	Set-Back Ratio: (Set-Back Length)/(Ave. Channel Flow Depth)	0.0	0.0	0.0	0.0	If SBR<5, use average bridge velocity
		SBR<5	SBR<5	SBR<5	SBR<5	If SBR≥5, use overbank flow velocity
L'	Length of Abutment Projected Normal to Flow, feet	0.00	2.63	3.30	3.30	From HEC-RAS, Section 309
B_f	Width of Floodplain, feet	0.00	2.63	3.30	3.30	Assume L' and B_f Approximately Equal
L' / B_f	If ≥ 0.75, then Figure 8.7a, assume Live-Bed, use Equation 8.5 If < 0.75, then Figure 8.7b, assume Clear-Water, use Equation 8.6	1.00	1.00	1.00	1.00	
	Contraction Scour Calculation:	Live-Bed	Live-Bed	Live-Bed	Live-Bed	

Live-Bed Contraction Scour Calculation

Variable		Discharge Frequency (years) 10	50	100	200	Notes
y_1	Channel Average Depth at Approach Section, feet	1.58	2.34	2.82	3.41	From HEC-RAS, Section 309
Q_1	Channel Flow through the Approach Section, cfs	150.00	310.00	450.00	540.00	From HEC-RAS, Section 309
W_1	Channel Top Width at the Approach Section, feet	24.04	25.30	25.30	25.30	From HEC-RAS, Section 309
q_1	Unit Discharge at the Approach Section, ft^2/s	6.24	12.25	17.79	21.34	Q_1 / W_1
Q_2	Channel Flow through the Bridge Opening, cfs	150.00	310.00	450.00	540.00	Flow through Bridge, excluding Weir Flow
W_2	Channel Top Width Inside the Bridge Opening, feet	28.66	28.66	28.66	28.66	Clear span length
q_{2c}	Unit Discharge in the Constricted Opening, ft^2/s	5.23	10.82	15.70	18.84	Q_2 / W_2
q_{2c} / q_1		0.84	0.88	0.88	0.88	
α_A	Amplification Factor for Live-Bed Conditions	1.20	1.20	1.20	1.20	Wingwall Abutments (Figure 8.10)
y_c	Flow Depth including Live-Bed Contraction Scour, feet	1.36	2.10	2.53	3.06	Equation 8.5
y_{max}	Maximum Flow Depth resulting from Abutment Scour, feet	1.63	2.52	3.04	3.68	Equation 8.3
y_o	Channel Average Depth Inside the Bridge Opening, feet	3.22	4.45	4.45	4.45	From HEC-RAS, Section 140 BR U
y_s	Live-Bed Contraction Scour Depth, feet =	0.00	0.00	0.00	0.00	(Equation 8.4)
			N/A, Qpress	N/A, Qpress	N/A, Qpress	

Clear-Water Contraction Scour Calculation

Variable		Discharge Frequency (years) 10	50	100	200	Notes
D_{50}	Size of Bed Material, mm	2.74	2.74	2.74	2.74	
q_{2f}	Unit Discharge in the Constricted Opening, ft^2/s	5.23	10.82	15.70	18.84	Q_2 / W_2
q_1	Unit Discharge at the Approach Section, ft^2/s	6.24	12.25	17.79	21.34	
q_{2f} / q_1		0.84	0.88	0.88	0.88	
α_B	Amplification Factor for Clear-Water Conditions	1.00	1.00	1.00	1.00	Wingwall Abutments (Figure 8.12)
y_c	Flow Depth including Clear-Water Contraction Scour, feet	2.01	3.74	5.15	6.02	Equation 8.6
y_{max}	Maximum Flow Depth resulting from Abutment Scour, feet	2.01	3.74	5.15	6.02	Equation 8.3
y_o	Channel Average Depth Inside the Bridge Opening, feet	3.22	4.45	4.45	4.45	From HEC-RAS, Section 140 BR U
y_s	Clear-Water Contraction Scour Depth, feet =	N/A	N/A	N/A	N/A	(Equation 8.4)
			N/A, Qpress	N/A, Qpress	N/A, Qpress	



LEGEND:

SOIL BORING

NOTE:

UTILITIES NOT SHOWN. SEE UTILITY PLAN ON SHEET 21 FOR UTILITIES INFORMATION.

KEY PLAN

SCALE: 1" = 20'

INDEX OF DRAWINGS

SHEET NO.	SHEET TITLE
1	TITLE SHEET
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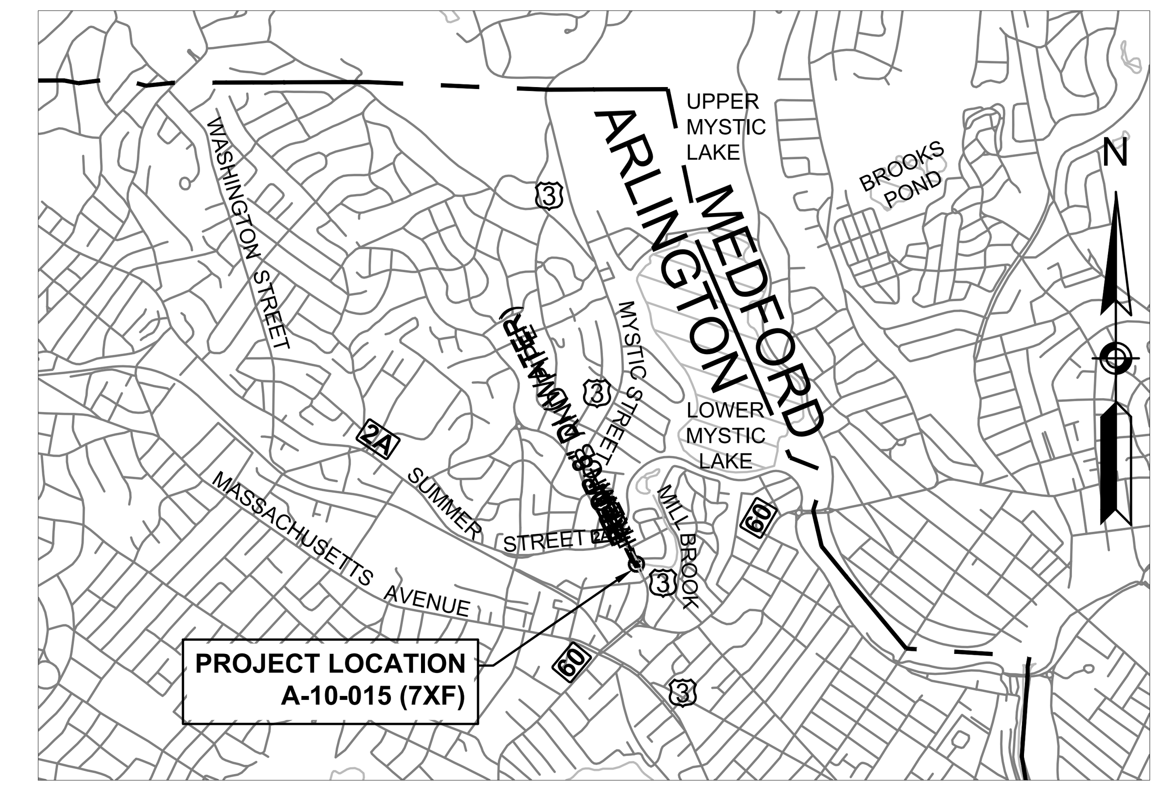
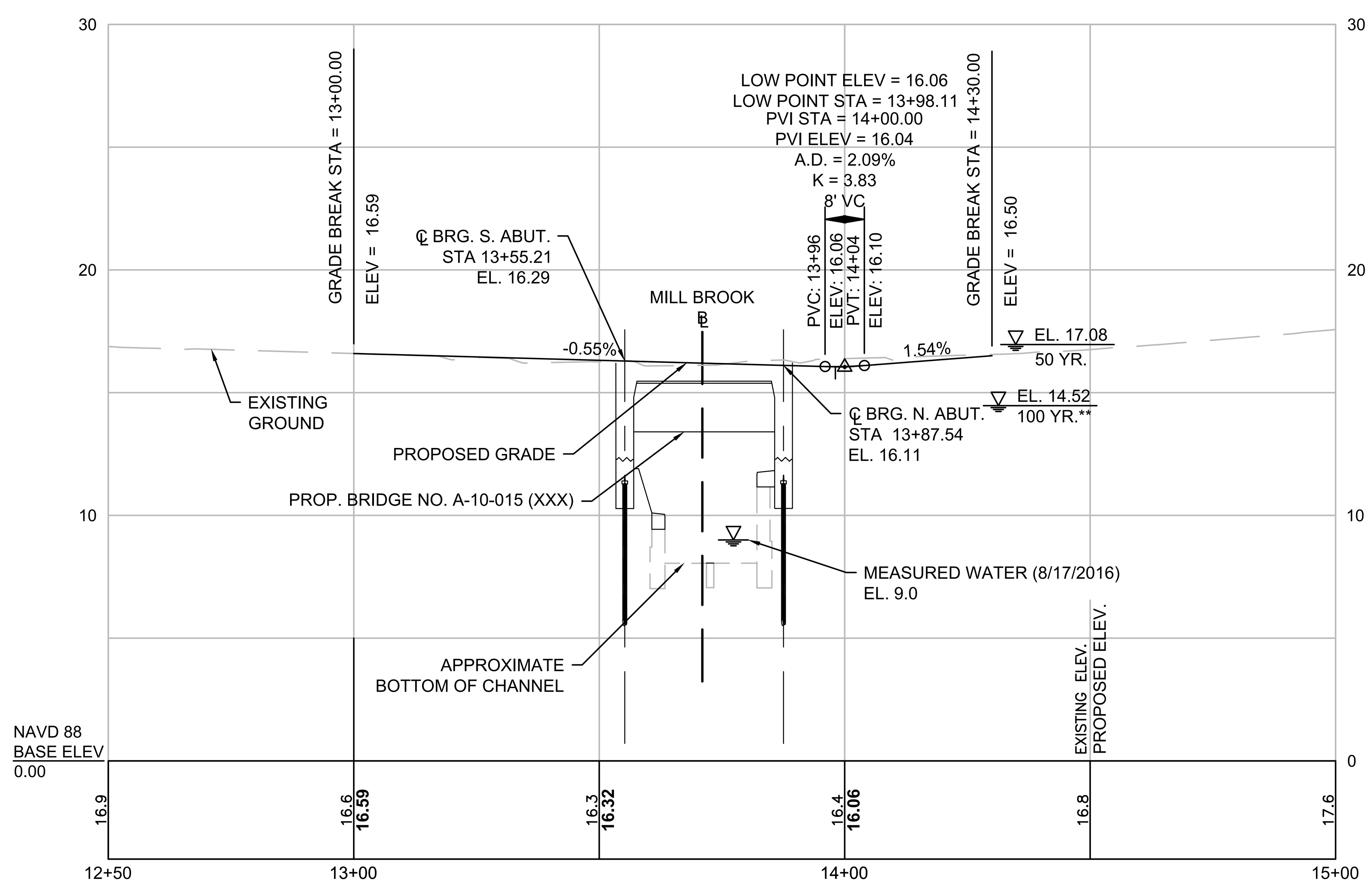
3	BORINGS
4	GENERAL PLAN & LONGITUDINAL SECTION
5	CONSTRUCTION STAGING PLAN
6	CONSTRUCTION STAGING
7	DEMOLITION DETAILS
8	FOUNDATION PLAN & MICROPILE DETAILS
9	SOUTH ABUTMENT
10	NORTH ABUTMENT
11	ABUTMENT DETAILS
12	CROSS SECTIONS
13	FRAMING PLAN
14	STEEL DETAILS
15	DECK DETAILS
16	S3-TL4 BRIDGE RAILING
17	END POST DETAILS
18	ROADWAY PLAN & TYPICAL SECTION
19	CURBTIE, GRADING & DRAINAGE PLAN
20	UTILITY PLAN
21	ADVANCE WARNING SIGN PLAN
22	TEMPORARY TRAFFIC CONTROL PLAN



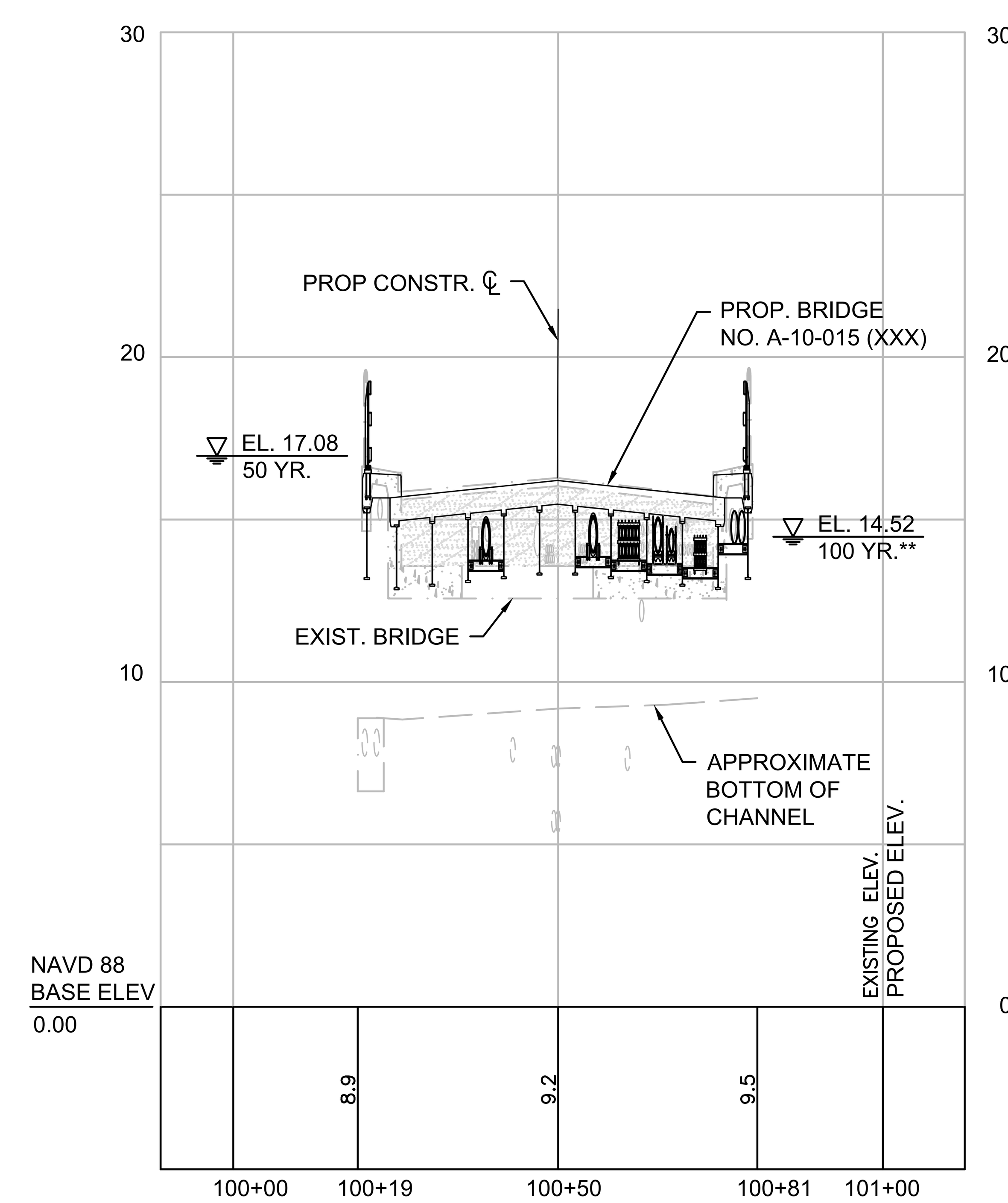
LOCUS

SCALE: 1" = 2000'



PROPOSED PROFILE – MYSTIC STREET

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'



PROFILE – MILL BROOK

HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 4'

63 KENDRICK STREET
NEEDHAM, MA 02494
781-355-7100
781-355-7101 (FAX)

GILL ENGINEERING

DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION
04/01/2021	ABL	ABL	AMS	CHAPTER 85 SUBMISSION

REGISTERED PROFESSIONAL ENGINEER

DATE

BRIDGE REPLACEMENT

TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

TITLE SHEET

SHEET 1 OF 25

GENERAL NOTES:

DESIGN:
IN ACCORDANCE WITH THE 2017 AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS LRFD BRIDGE DESIGN SPECIFICATIONS WITH CURRENT INTERIM SPECIFICATIONS THROUGH 2018, FOR HL-93 LOADING.

MASSDOT BENCH MARK:
ALL ELEVATIONS ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988.

XCUT NE BOLT 1420
NORTHING : 2977770.777
EASTING: 750334.732
ELEVATION: 17.29

EXISTING PLANS:
PLANS FOR THE EXISTING BRIDGE ARE AVAILABLE THROUGH THE MASSACHUSETTS DEPARTMENT OF TRANSPORTATION PLANS AND RECORDS ROOM, 10 PARK PLAZA, BOSTON, MA.

REPORTS:
SEE GEOTECHNICAL REPORT DATED DECEMBER 2017.
SEE HYDRAULIC REPORT DATED DECEMBER 2017.

EXISTING CONDITIONS:
EXISTING DIMENSIONS ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND VERIFY ALL PRESENT DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ADEQUACY AND ACCURACY THEREOF, AND SHALL NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL HE/SHE HAS MADE THE REQUIRED MEASUREMENTS, AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

UTILITIES:
THE CONTRACTOR SHALL LOCATE AND PROTECT FROM DAMAGE ALL EXISTING UTILITIES. THE CONTRACTOR SHALL COORDINATE AND COOPERATE WITH THE RESPECTIVE UTILITY OWNERS FOR ALL UTILITIES TO BE PERMANENTLY RELOCATED.

SURVEY:
FIELD SURVEY PERFORMED BY WESTON & SAMPSON FROM ON 8/17/2016. COPIES OF ELECTRONIC FILES MAY BE OBTAINED FROM GILL ENGINEERING ASSOCIATES.

SCALES:
SCALES NOTED ON THE PLANS ARE NOT APPLICABLE TO REDUCED SIZE PRINTS. DIVIDE SCALES BY 2 FOR HALF-SIZE PRINTS.

FOUNDATIONS:
FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER.

CONCRETE:
4000 PSI, ¾ IN., 585 HP CEMENT CONCRETE	DECK, ABUT. DIAPHRAGMS, ABUT. PILE CAPS, TOPPING SLABS
5000 PSI, ¾ IN., 685 HP CEMENT CONCRETE	SIDEWALKS, END POSTS

REINFORCEMENT:
REINFORCING STEEL SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M31 GRADE 60. UNLESS OTHERWISE NOTE ON THE CONSTRUCTION DRAWINGS, ALL BARS SHALL BE LAPPED AS FOLLOWS:

MODIFICATION CONDITION	#4 BARS	#5 BARS	#6 BARS
1. NONE	16"	19"	23"
2. 12" OF CONCRETE BELOW BAR	20"	25"	30"
3. COATED BARS, COVER < 3db, OR CLEAR SPACING < 6db	23"	29"	34"
4. COATED BARS, ALL OTHER CASES	18"	23"	27"
5. CONDITION 2 AND 3	26"	32"	39"
6. CONDITION 2 AND 4	24"	30"	36"

ALL OTHER BARS SHALL BE LAPPED AS SHOWN ON THE CONSTRUCTION DRAWINGS.

STRUCTURAL STEEL:
ALL STRUCTURAL STEEL MEMBERS SHALL BE AASHTO M270 GRADE 50, HOT DIPPED GALVANIZED. FASCIA GIRDERS TO BE HOT DIPPED GALVANIZED AND PAINTED, COLOR NUMBER 14223, GREEN OF THE FEDERAL STANDARD 595B. ALL BOLTS SHALL BE ASTM F3125 GRADE A325 TYPE I MECHANICALLY GALVANIZED IN ACCORDANCE WITH AASHTO M298 (ASTM B695) CLASS 50. UNLESS OTHERWISE NOTED, NUTS AND WASHERS SHALL BE LISTED AS SUITABLE IN THE ASTM F3125 SPECIFICATION FOR GRADE A325. NUTS SHALL BE MECHANICALLY GALVANIZED BY THE SAME PROCESS AND SHALL BE LUBRICATED WITH LUBRICANT CONTAINING VISIBLE DYE. BOLTS, NUTS, AND WASHERS SHALL BE FIELD PAINTED AFTER INSTALLATION.

PLAN REVISION:
IF THERE ARE REVISIONS TO THE APPROVED PLANS, THE CONTRACTOR SHALL SUBMIT THESE CHANGES TO THE ENGINEER OF RECORD FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION. ONCE THESE REVISIONS ARE APPROVED BY THE MUNICIPALITY'S DESIGNER OF RECORD, AS-BUILT PLANS SHALL BE SUBMITTED TO MASSDOT.

HYDRAULIC DESIGN DATA

DRAINAGE AREA:	5.05	SQ. MILES
DESIGN FLOOD DISCHARGE:	750	C.F.S
DESIGN FLOOD FREQUENCY:	50	YEARS
DESIGN FLOOD VELOCITY:	3.27	F.P.S.
DESIGN FLOOD ELEVATION:	17.08	FEET, NAVD

BASE (100-YEAR) FLOOD DATA

BASE FLOOD DISCHARGE:	450	C.F.S
BASE FLOOD ELEVATION:	14.52	FEET, NAVD

DESIGN AND CHECK SCOUR DATA
DESIGN SCOUR FLOOD EVENT RETURN FREQUENCY: 100 YEARS
CHECK SCOUR FLOOD EVENT RETURN FREQUENCY: 500 YEARS

FLOOD OF RECORD

DISCHARGE:	UNKNOWN
FREQUENCY (IF KNOWN):	UNKNOWN
MAXIMUM ELEVATION:	UNKNOWN
DATE:	UNKNOWN
HISTORY OF ICE FLOES:	NONE DOCUMENTED IN NBIS DATABASE
EVIDENCE OF SCOUR AND EROSION:	NONE DOCUMENTED IN NBIS DATABASE

**THE 100-YR BASE FLOOD DATA IS FROM THE FEMA FIS

SEISMIC DESIGN CRITERIA

DESIGN RETURN PERIOD:	2500
DESIGN SPECTRA	
As	0.16G
SDs	0.26G
SD1	0.14G
SITE CLASS	D
SEISMIC DESIGN CATEGORY (SDC)	A

ABBREVIATIONS

ABAN	ABANDON
BO	BY OTHERS
CB	CATCH BASIN
CI	CAST IRON
DI	DROP INLET
DIP	DUCTILE IRON PIPE
DMH	DRAINAGE MANHOLE
FRE	FIBERGLASS REINFORCED EPOXY
EOC	EDGE OF CHANNEL
GI	GUTTER INLET
PROT	PROTECT
RCP	REINFORCED CONCRETE PIPE
REM	REMOVE
RET	RETAIN
TYP	TYPICAL

QUANTITIES

NO.	ITEM	UNIT	QUANTITY
115.1	DEMOLITION OF BRIDGE NO. A-10-015	LS	1
120.	EARTH EXCAVATION	CY	110
140.	BRIDGE EXCAVATION	CY	405
141.	CLASS A TRENCH EXCAVATION	CY	25
142.	CLASS B TRENCH EXCAVATION	CY	32
151.	GRAVEL BORROW	CY	55
151.1	GRAVEL BORROW FOR BRIDGE FOUNDATION	CY	85
156.	CRUSHED STONE	TON	5
170.	FINE GRADING AND COMPACTING - SUBGRADE AREA	SY	55
201.	CATCH BASIN	EA	4
202.	MANHOLE	EA	3
204.	GUTTER INLET	EA	1
221.	FRAME AND COVER	EA	4
222.1	FRAME AND GRATE - MASSDOT CASCADE TYPE	EA	4
224.12	12 INCH HOOD	EA	4
238.10	10 INCH DUCTILE IRON PIPE	FT	15
238.15	15 INCH DUCTILE IRON PIPE	FT	25
241.12	12 INCH REINFORCED CONCRETE PIPE	FT	7
303.08	8 INCH DUCTILE IRON WATER PIPE (MECHANICAL JOINT)	FT	-
309.	DUCTILE IRON FITTINGS FOR WATER PIPE	LB	-
373.08	8 INCH WATER PIPE INSULATION	FT	-
402.	DENSE GRADED CRUSHED STONE FOR SUB-BASE	CY	25
415.1	PAVEMENT STANDARD MILLING	SY	305
440.	CALCIUM CHLORIDE FOR ROADWAY DUST CONTROL	LB	915
443.	WATER FOR ROADWAY DUST CONTROL	MGL	10
451.	HMA FOR PATCHING	TON	5
452.	ASPHALT EMULSION FOR TACK COAT	GAL	65
453.	HMA JOINT SEALANT	FT	325
460.22	SUPERPAVE SURFACE COURSE - 9.5 (SSC - 9.5)	TON	45
460.32	SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC 19.0)	TON	30
460.42	SUPERPAVE BASE COURSE - 37.5 (SBC 37.5)	TON	55
472.	TEMPORARY ASPHALT PATCHING	TON	5
482.4	SAWCUTTING PORTLAND CEMENT CONCRETE	FT	45
504.	GRANITE CURB TYPE VA4 - STRAIGHT	FT	130
581.	CURB INLET REMOVED AND RESET	EA	4
701.	CEMENT CONCRETE SIDEWALK	SY	45
748.	MOBILIZATION	LS	1
751.	LOAM BORROW	CY	5
765.	SEEDING	SY	30
852.	SAFETY SIGNING FOR TRAFFIC MANAGEMENT	SF	320
853.1	PORTABLE BREAKAWAY BARRICADE TYPE III	EA	2
853.2	TEMPORARY BARRIER (TL-2)	FT	180
853.21	TEMPORARY BARRIER REMOVED AND RESET	FT	290
853.501	TEMPORARY IMPACT ATTENUATOR REMOVED AND RESET	EA	4
853.72	TEMPORARY IMPACT ATTENUATOR BI-DIRECTIONAL, NON-REDIRECTIVE (TL-2)	EA	2
854.036	TEMPORARY PAVING MARKINGS - 6 INCH (TAPE)	FT	2155
854.1	PAVEMENT MARKING REMOVAL	SF	75
859.	REFLECTORIZED DRUM	DAY	1020
866.106	6 INCH REFLECTORIZED WHITE LINE (THERMOPLASTIC)	FT	930
867.106	6 INCH REFLECTORIZED YELLOW LINE (THERMOPLASTIC)	FT	360
903.	3000 PSI, 1.5 INCH, 470 CEMENT CONCRETE	CY	-
948.60	MICROPILE VERIFICATION LOAD TEST	EA	1
948.61	MICROPILE PROOF LOAD TEST	EA	2
945.10	DRILLED MICROPILES	FT	740
950.5	TEMPORARY SUPPORT OF EXCAVATION	SF	1000
983.22	PLACED RIPRAP	CY	395
991.1	CONTROL OF WATER - STRUCTURE NO. A-10-015	LS	1
992.33	TEMPORARY SUPPORT FOR UTILITIES	LS	1
995.01	BRIDGE STRUCTURE, BRIDGE NO. A-10-015	LS	1

GILL ENGINEERING
63 KENDRICK STREET
NEEDHAM, MA 02494
781-355-7100
781-355-7101 (FAX)

A10015_BR_GEN NOTES.DWG Plotted on 2-Apr-2021 11:40 AM

DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION
04/01/2021	FB	FB	AMS	CHAPTER 85 SUBMISSION

REGISTERED PROFESSIONAL ENGINEER

DATE

BRIDGE REPLACEMENT
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

GENERAL NOTES

SHEET 2 OF 25

Geologic - Earth Exploration, Inc.

7 Sherwood Drive, Norfolk, MA 02056
TEL 508 384 4434, FAX 508 384 4452

CLIENT:	Gill Engineering, Inc.	BORING #:	B-1
PROJECT:	91 Mystic Street	PAGE	1 OF 1
LOCATION:	Arlington, MA		

			CASING	SAMPLER	CORE BARREL		
File #:	17143					Surface Elevation:	
Date Started:	8/28/17	TYPE	HW	SS		Station:	
Date Completed:	8/29/17	SIZE	4"	2 3/8"		Groundwater level readings	
Driller:	P.Fisher	HAMMER	300#	140#	---	Date	Depth N/O
Site Rep.:		FALL	30"	30"	---	Date	Depth

Depth ft	No.	Depth ft	Pen. in	Rec. in	Blows/6"	Sample Description
	S-1	0.0-2.0	24	12	2-2-2-2	S-1 Dry loose brown fine to medium SAND and GRAVEL
	S-2	4.0-6.0	24	6	2-2-2-2	S-2 Moist loose brown medium to coarse SAND and GRAVEL, some fine Sand
10	S-3	9.0-11.0	24	1	18-12-10-10	S-3 Moist medium dense gray to brown fine to coarse GRAVEL
	S-4	14.0-16.0	24	2	15-5-5-4	S-4 Moist medium dense dark gray fine to coarse GRAVEL, some Sand
20	S-5	19.0-21.0	24	1	9-4-9-8	S-5 Moist medium dense gray fine to medium GRAVEL, trace Sand
	S-6	24.0-26.0	24	12	11-10-6-4	S-6 Moist medium dense gray fine SAND, trace of Silt and Gravel
30	S-7	29.0-31.0	24	6	16-16-12-11	S-7 Similar to S-6
	S-8	34.0-36.0	24	6	14-10-9-10	S-8 Similar to S-6
40	S-9	39.0-41.0	24	8	13-8-7-8	S-9 Moist medium dense gray fine SAND and GRAVEL, some fine to coarse Sand
	S-10	44.0-46.0	24	6	11-13-6-9	S-10 Similar to S-9
50	S-11	49.0-51.0	24	4	9-6-5-8	S-11 Moist medium dense fine to coarse SAND and GRAVEL, little fine Sand
	S-12	54.0-56.0	24	8	7-14-10-13	S-12 Moist medium dense gray GRAVEL and fine to coarse SAND
60	S-13	59.0-61.0	24	8	15-9-10-12	S-13 Moist medium dense gray fine to coarse SAND, little Gravel
						Bottom of exploration at 61.0' -0'-41' DONUT HAMMER USED -41'-56' AUTOMATIC HAMMER USED

Ground Surface to ______ used ______ then ______

Proportions Used		Cohesive Consistency Blows/ft				Cohesionless Density Blows/ft		Sample Type
Trace	0 to 10%	0-2	Very Soft	9-15	Stiff	0-10	Loose	UP = Fixed Piston
Little	10 to 20%	3-4	Soft	16-30	V-Stiff	10-30	M-Dense	UT = Shelby Tube
Some	20 to 35%	5-8	M-Stiff	31+	Hard	30-50	Dense	OE = Open End Rod
And	35 to 50%					50+	V-Dense	* = 300# hammer

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks: NOTE: All soil descriptions are made in the field by the Drilling Foreman. No laboratory analyses were performed for this purpose.

BL ALL 17143 GILL, ARLINGTON, MA.GPJ GEOLOGIC.GDT 11/3/17

BOTTOM OF PROP. SOUTH ABUTMENT EL. 10.37

EST. PILE TIP EL. −26.63

NOTE:
APPROXIMATE LOCATION OF BB−1
GROUND SURFACE EL. 15.0
STA 13+14.9, OFFSET 41.33' RT

Geologic - Earth Exploration, Inc.

7 Sherwood Drive, Norfolk, MA 02056
TEL 508 384 4434, FAX 508 384 4452

CLIENT:	Gill Engineering, Inc.	BORING #:	B-2
PROJECT:	91 Mystic Street	PAGE	1 OF 1
LOCATION:	Arlington, MA		

			CASING	SAMPLER	CORE BARREL		
File #:	17143					Surface Elevation:	
Date Started:	8/29/17	TYPE	HW	SS		Station:	
Date Completed:	8/30/17	SIZE	4"	1 3/8"		Groundwater level readings	
Driller:	K.Eastwood	HAMMER	300#	140#	---	Date	Depth N/O
Site Rep.:		FALL	30"	30"	---	Date	Depth

Depth ft	No.	Depth ft	Pen. in	Rec. in	Blows/6"	Sample Description
	S-1	0.0-2.0	24	6	2-5-4-5	S-1 Moist stiff brown SILT and fine SAND, TOPSOIL and Roots
	S-2	4.0-6.0	24	5	7-2-2-3	S-2 Moist loose dark brown fine to coarse SAND, some sandy Silt
10	S-3	9.0-11.0	24	3	17-11-15-16	S-3 Moist medium dense gray fine to coarse GRAVEL, some silty Sand
	S-4	14.0-16.0	24	5	8-9-6-13	S-4 Moist medium dense gray fine to coarse SAND and GRAVEL, trace gray Silt
20	S-5	19.0-21.0	24	6	6-8-9-7	S-5 Moist medium dense gray fine to medium GRAVEL, little Sand
	S-6	24.0-26.0	24	6	9-8-5-8	S-6 Moist medium dense gray fine to coarse GRAVEL, little gray Sand
30	S-7	29.0-31.0	24	5	8-9-8-9	S-7 Similar to S-6
	S-8	34.0-36.0	24	2	13-13-11-12	S-8 Similar to S-6
40	S-9	39.0-41.0	24	5	14-16-13-15	S-9 Moist medium dense gray fine to coarse SAND and GRAVEL
	S-10	44.0-46.0	24	8	11-12-11-14	S-10 Similar to S-9
50	S-11	49.0-51.0	24	9	12-15-14-14	S-11 Moist medium dense brown SAND and GRAVEL, little Loam and fine Sand
	S-12	54.0-56.0	24	10	21-23-22-17	S-12 Moist medium dense gray fine to coarse SAND and GRAVEL, trace gray Silt No sample was recovered with the 2" split sppon. 3" split sppon used instead. Rock was found at the end of the sample
	S-13	56.0-58.0	24	12	10-9-9-8	S-13 Moist medium dense gray fine to coarse silty SAND, trace gray Silt 2' Split spoon extension used w/o drilling
60						Bottom of exploration at 58.0' AUTOMATIC HAMMER USED

Ground Surface to ______ used ______ then ______

Proportions Used		Cohesive Consistency Blows/ft				Cohesionless Density Blows/ft		Sample Type
Trace	0 to 10%	0-2	Very Soft	9-15	Stiff	0-10	Loose	UP = Fixed Piston
Little	10 to 20%	3-4	Soft	16-30	V-Stiff	10-30	M-Dense	UT = Shelby Tube
Some	20 to 35%	5-8	M-Stiff	31+	Hard	30-50	Dense	OE = Open End Rod
And	35 to 50%					50+	V-Dense	* = 300# hammer

Notes:
1. The stratification lines represent the approximate boundary between soil types. The transition may be gradual.
2. Water level readings were made in the drill hole during or at the completion of drilling. The water level may fluctuate over time.

Remarks: NOTE: All soil descriptions are made in the field by the Drilling Foreman. No laboratory analyses were performed for this purpose.

BL ALL 17143 GILL, ARLINGTON, MA.GPJ GEOLOGIC.GDT 11/3/17

BOTTOM OF PROP. NORTH ABUTMENT EL. 10.19

EST. PILE TIP EL. −26.81

NOTE:
APPROXIMATE LOCATION OF BB−2
GROUND SURFACE EL. 16.0
STA 14+10.3, OFFSET 56.5' LT

BORING NOTES:

1. LOCATION OF BORINGS SHOWN ON THE KEY PLAN THUS: ⌖
2. BORINGS ARE TAKEN FOR PURPOSE OF DESIGN AND SHOW CONDITIONS AT BORINGS POINTS ONLY, BUT DO NOT NECESSARILY SHOW THE NATURE OF MATERIALS TO BE ENCOUNTERED DURING CONSTRUCTION.
3. WATER LEVELS SHOWN ON THE BORING LOGS WERE OBSERVED AT THE TIME OF TAKING BORINGS AND DO NOT NECESSARILY SHOW THE TRUE GROUND WATER LEVEL.
4. FIGURES IN COLUMNS INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE A $1\frac{3}{8}$" I.D. SPLIT SPOON SAMPLER 6" USING A 140 POUND WEIGHT FALLING 30".
5. ALL BORINGS WERE MADE IN AUGUST 2017.
6. BORINGS WERE MADE BY: GEOLOGIC – EARTH EXPLORATION, INC., 7 SHERWOOD DRIVE, NORFOLK, MA 02056
7. THE NORTH AMERICAN VERTICAL DATUM (NAVD) OF 1988 IS USED THROUGHOUT.
8. BORING SAMPLES ARE STORED IN THE ARLINGTON DEPARTMENT OF PUBLIC WORKS BUILDING AT 51 GROVE STREET, ARLINGTON, MA. THE CONTRACTOR MAY EXAMINE THE SOIL AND ROCK SAMPLES BY CONTACTING THE ENGINEERING DIVISION AT 781−316−3320.

63 KENDRICK STREET
NEEDHAM, MA 02494
781-355-7100
781-355-7101 (FAX)
GILL ENGINEERING

DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION
04/01/2021	FB	FB	AMS	CHAPTER 85 SUBMISSION

REGISTERED PROFESSIONAL ENGINEER

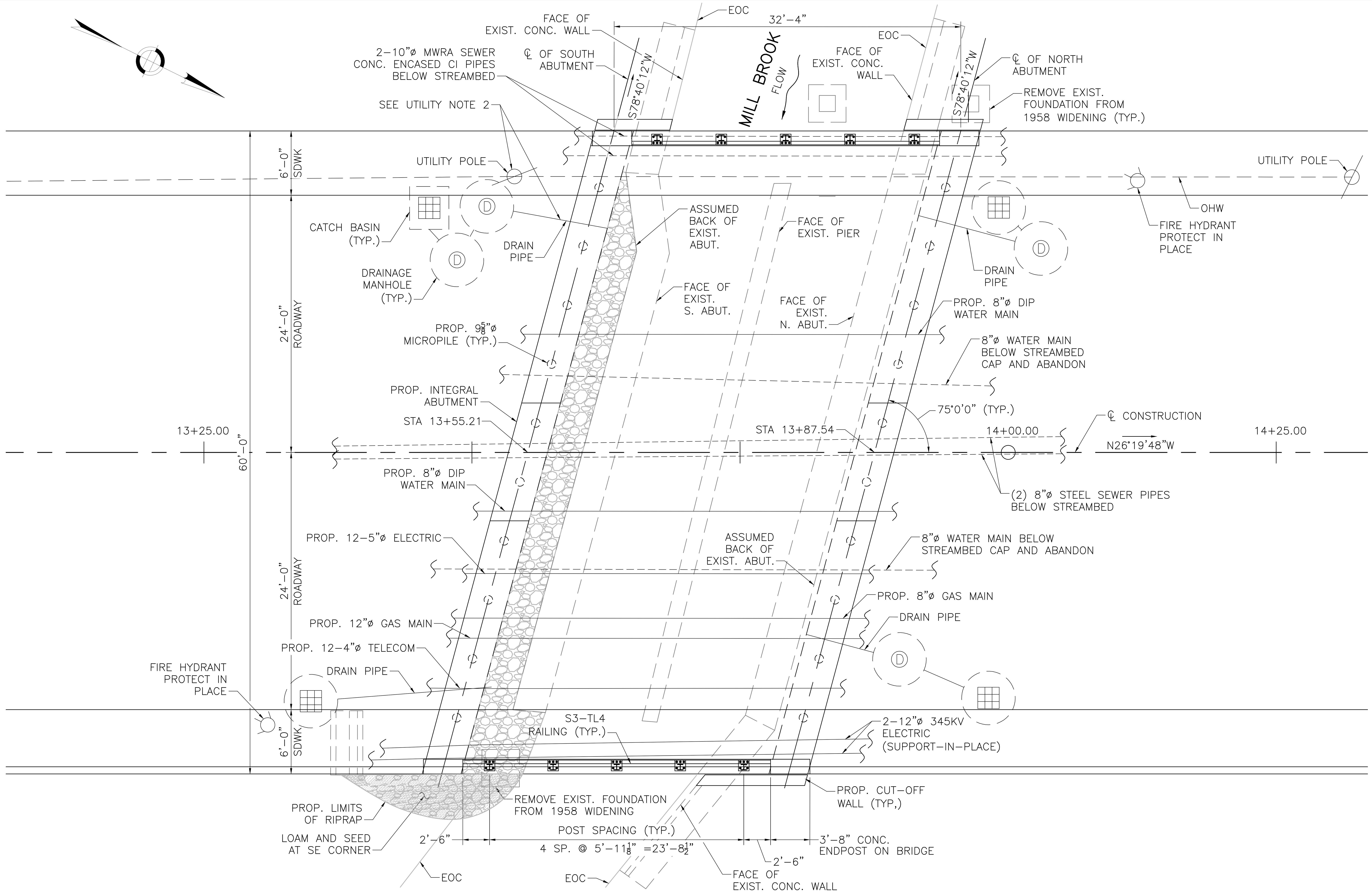
DATE

BRIDGE REPLACEMENT
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A−10−015 (XXX)
US3 (MYSTIC STREET) OVER MILL BROOK

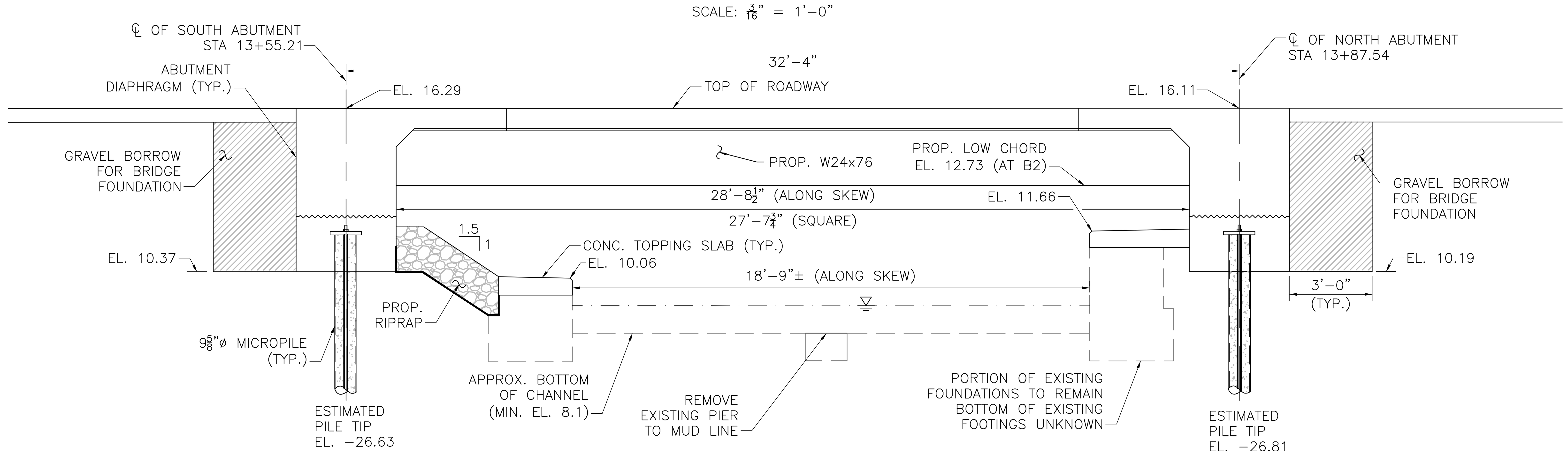
BORINGS

SHEET 3 OF 25



PLAN OF BRIDGE

SCALE: 3/16" = 1'-0"



LONGITUDINAL SECTION OF BRIDGE

SCALE: 3/8" = 1'-0"

UTILITY NOTES:

1. EXISTING UTILITIES TO BE RELOCATED ARE OMITTED FOR CLARITY.
2. ONLY UTILITIES AND UTILITY STRUCTURES WITHIN THE BRIDGE ARE SHOWN FOR CLARITY. SEE SHEET 21 FOR INFORMATION NOT SHOWN.
3. CONTRACTOR TO COORDINATE WITH UTILITY COMPANY TO PROVIDE ADEQUATE SUPPORT TO UTILITY POLE DURING THIS PHASE OF CONSTRUCTION.

SUBSTRUCTURE NOTES:

1. EXISTING ABUTMENTS AND PIER LIMITS ARE APPROXIMATE.
2. EXISTING ABUTMENTS ARE DRY LAID GRANITE, THUS DEMOLITION LIMITS SHOWN ARE APPROXIMATE.

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GILL ENGINEERING

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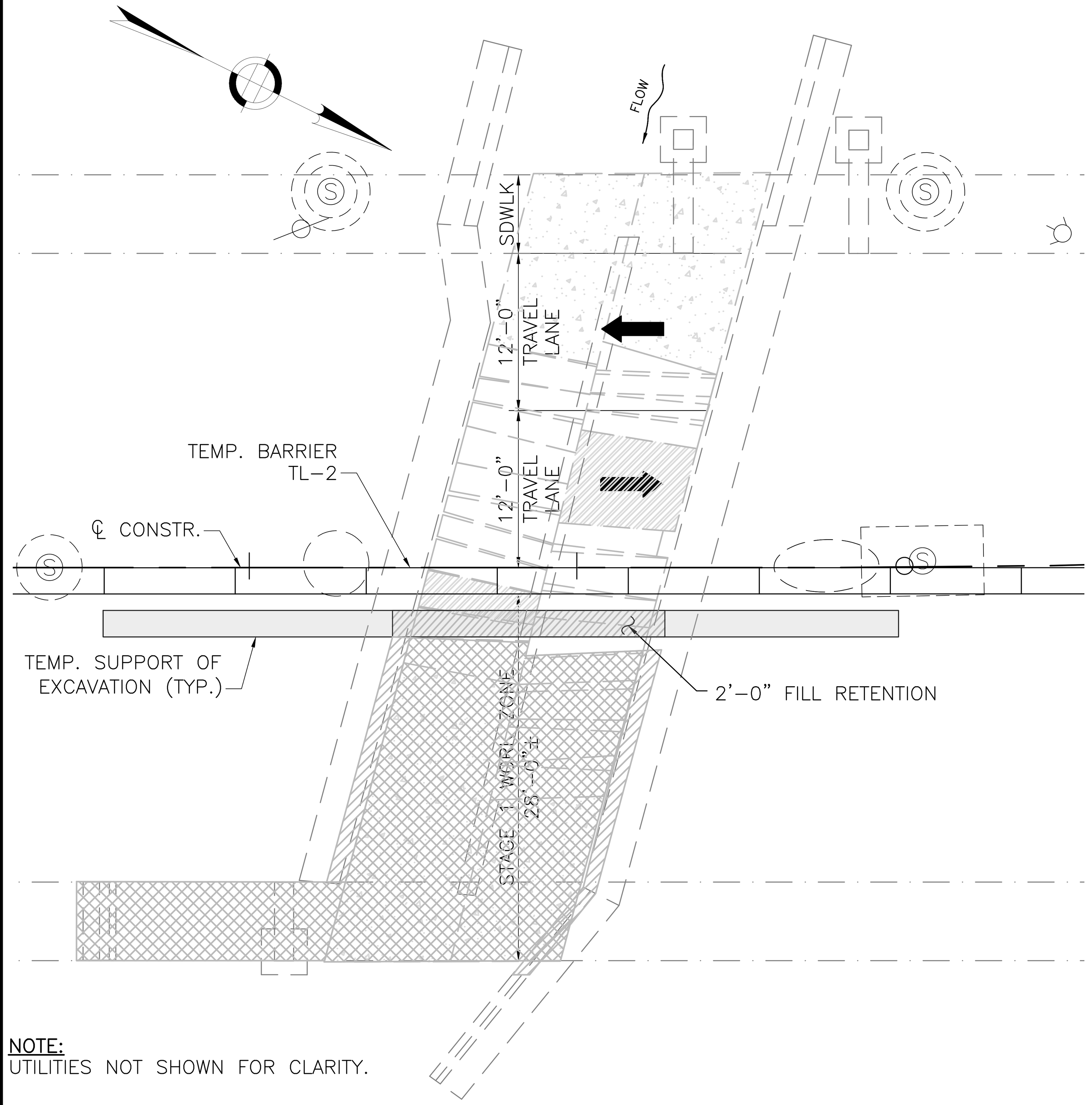
BRIDGE REPLACEMENT

TOWN OF ARLINGTON

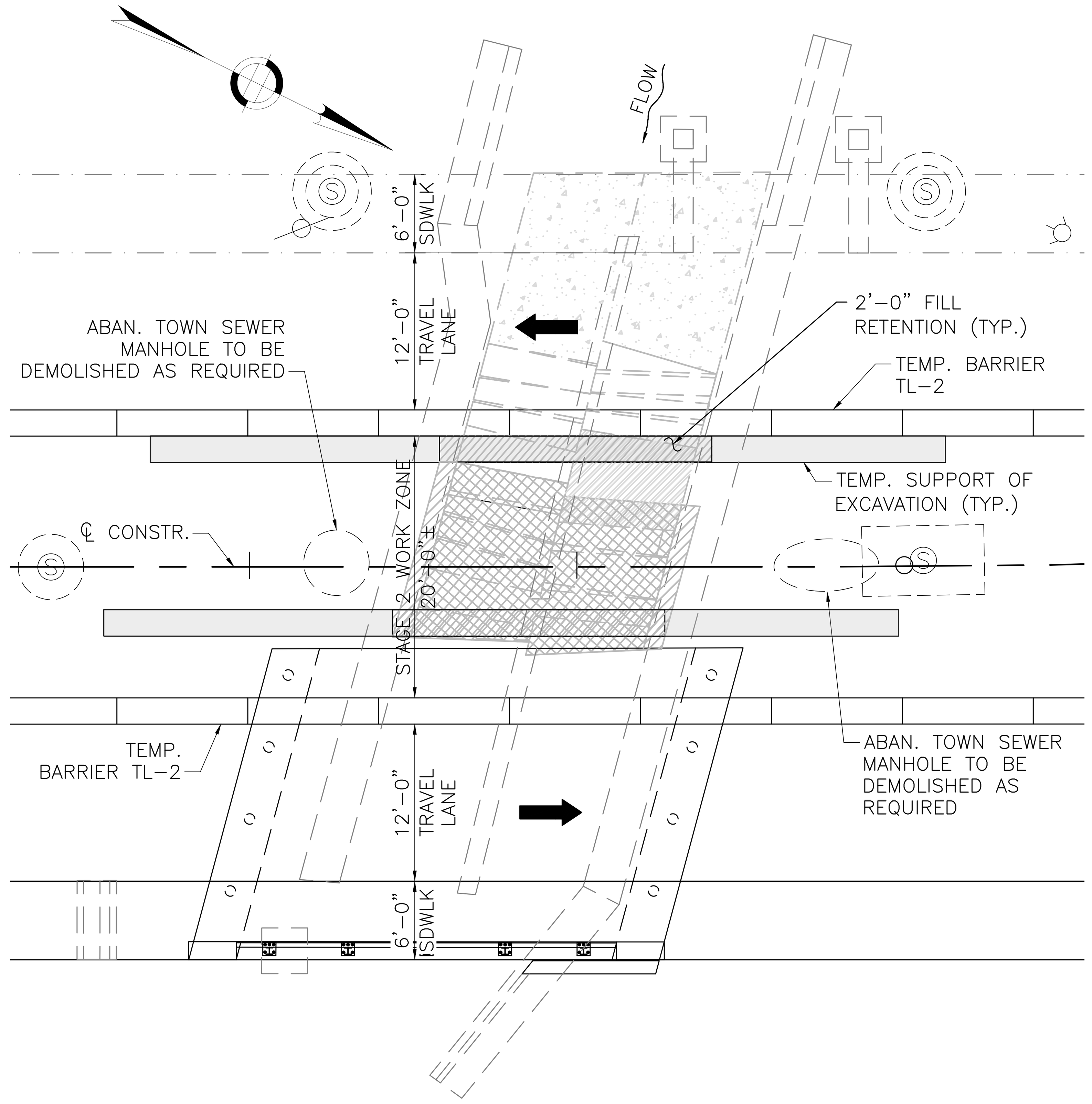
PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

GENERAL PLAN & LONGITUDINAL SECTION

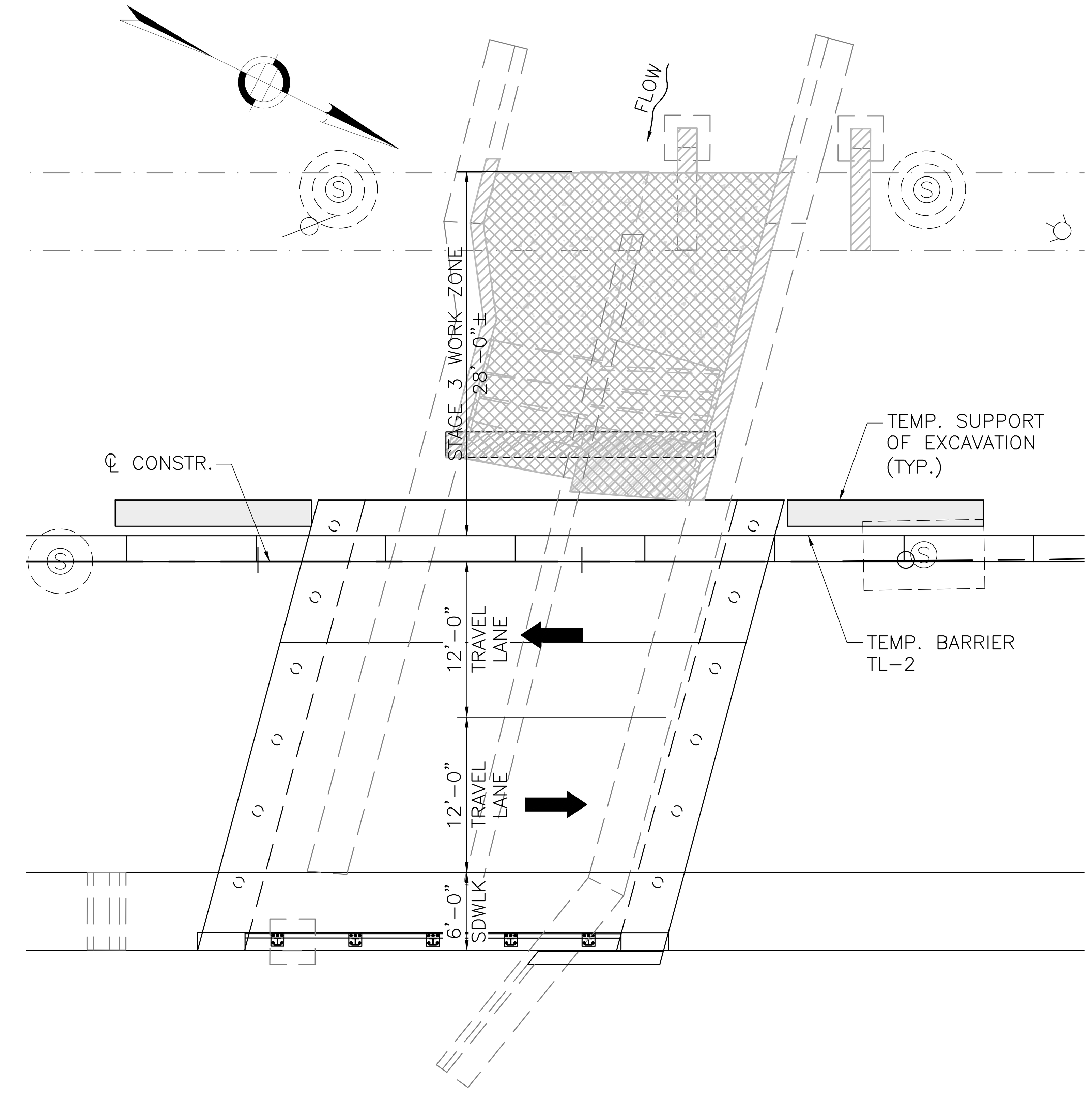
SHEET 4 OF 25



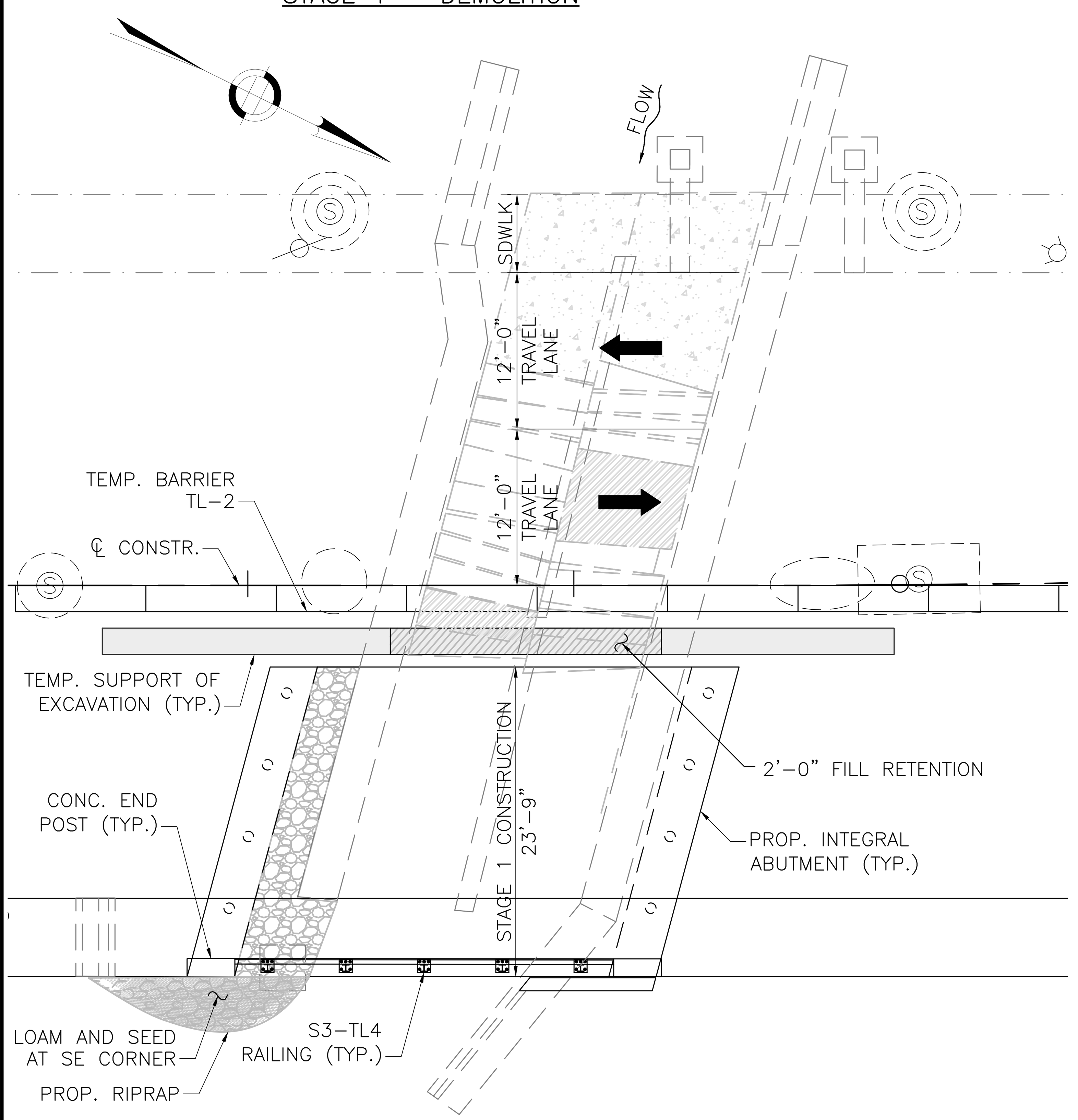
STAGE 1 – DEMOLITION



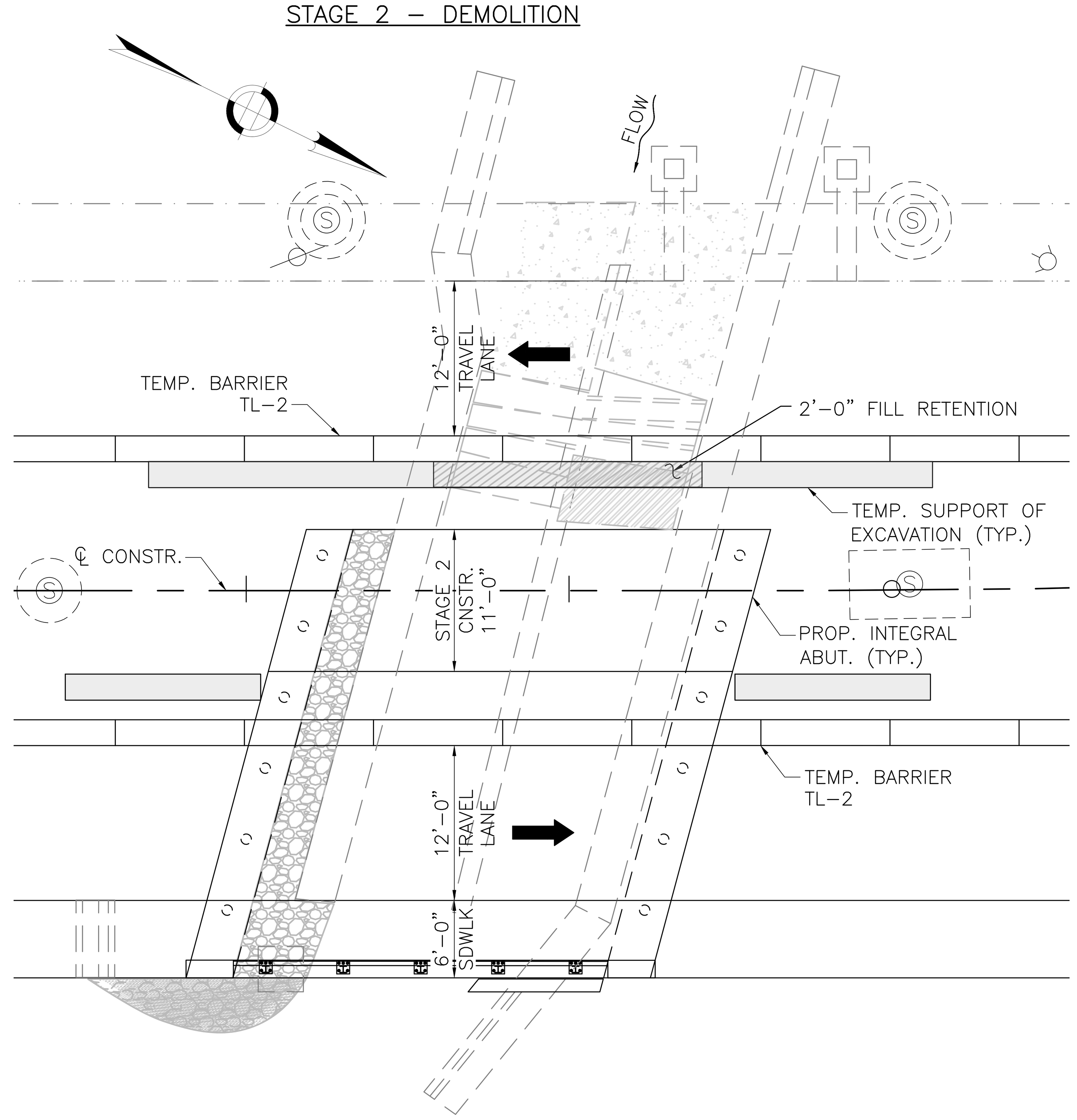
STAGE 2 – DEMOLITION



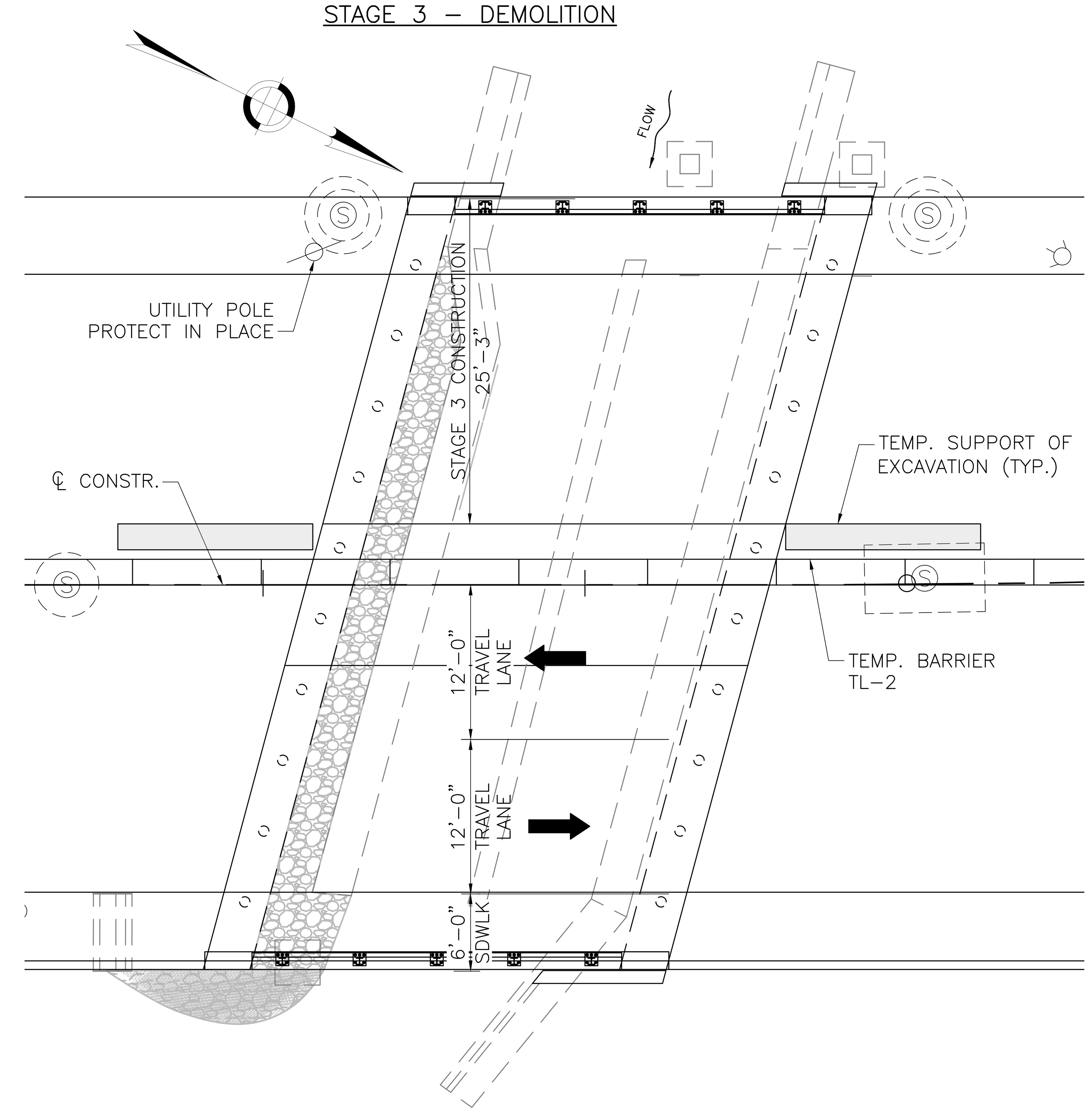
STAGE 3 – DEMOLITION



STAGE 1 – CONSTRUCTION



STAGE 2 – CONSTRUCTION



STAGE 3 – CONSTRUCTION

CONSTRUCTION STAGING PLAN

SCALE: $\frac{1}{8}$" = 1'-0"

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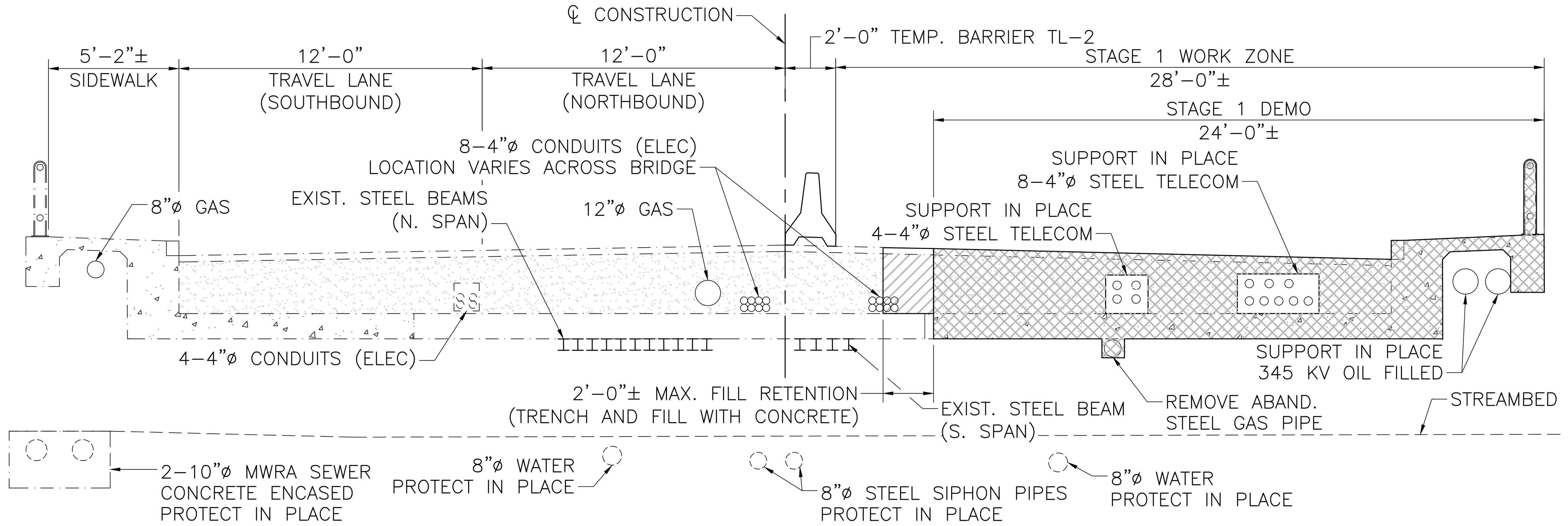
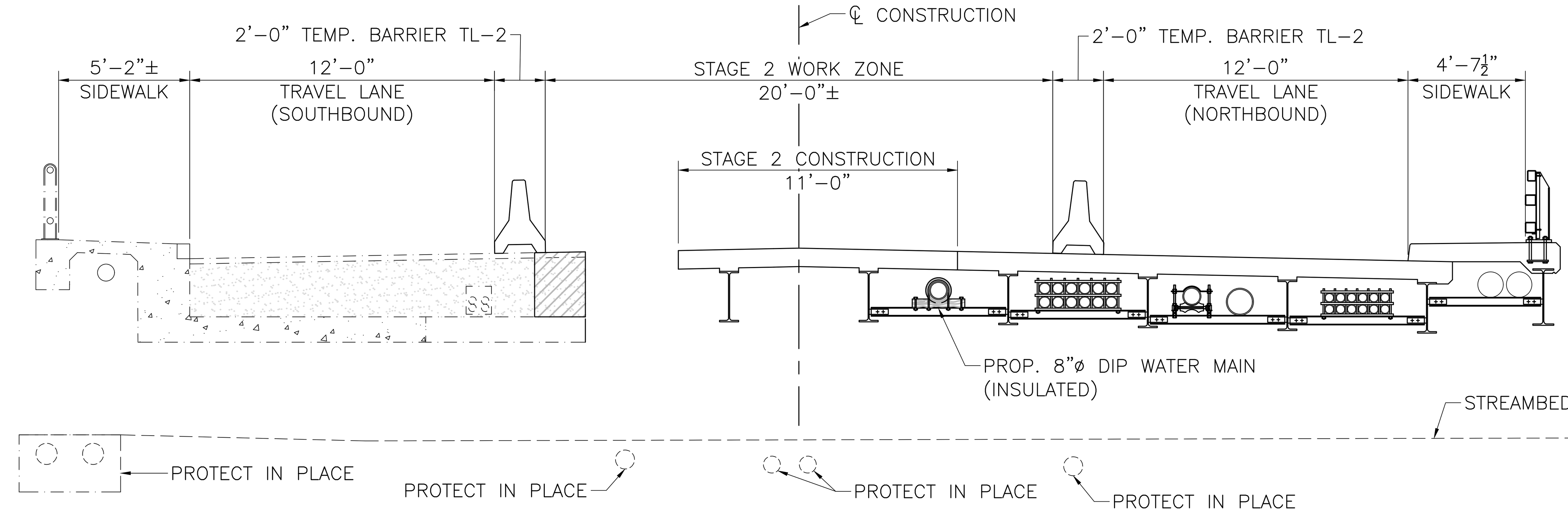
US3 (MYSTIC STREET) OVER MILL BROOK

CONSTRUCTION STAGING PLAN

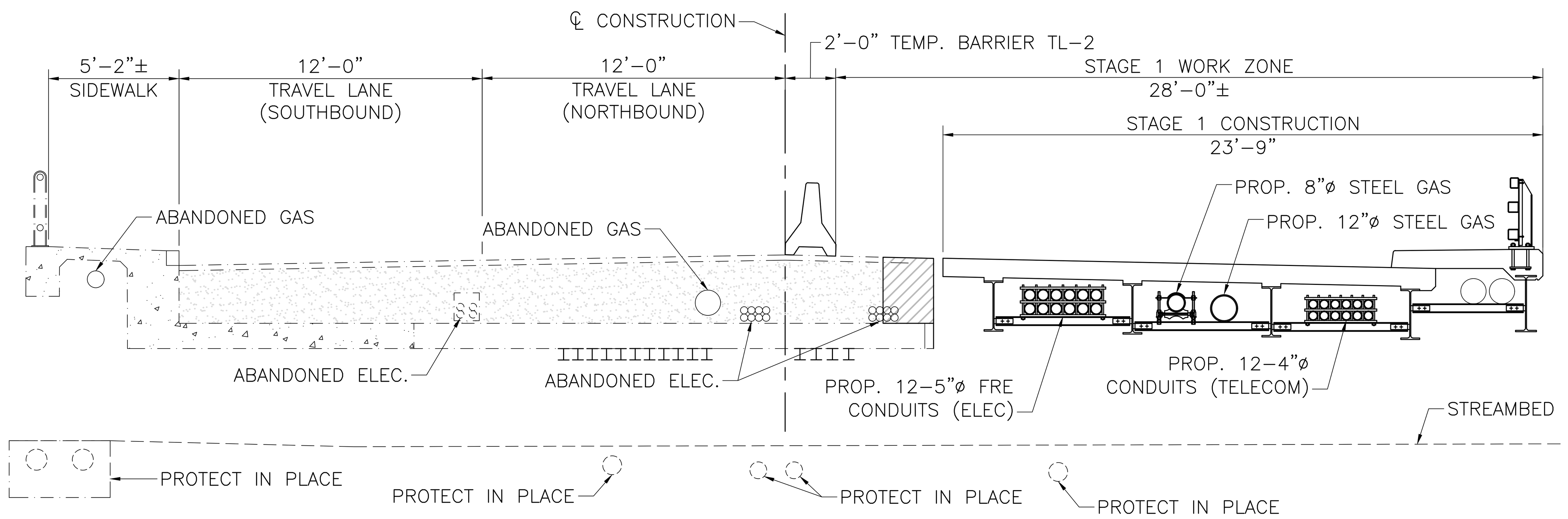
SHEET 5 OF 25



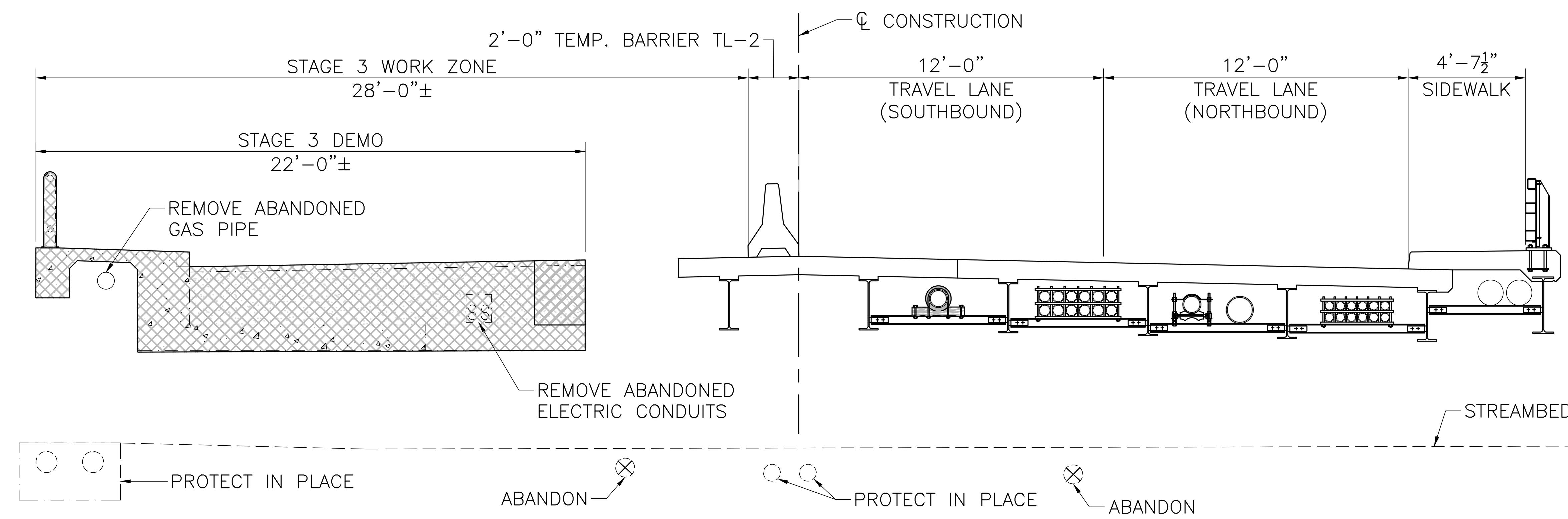
STAGE 1 – DEMOLITION



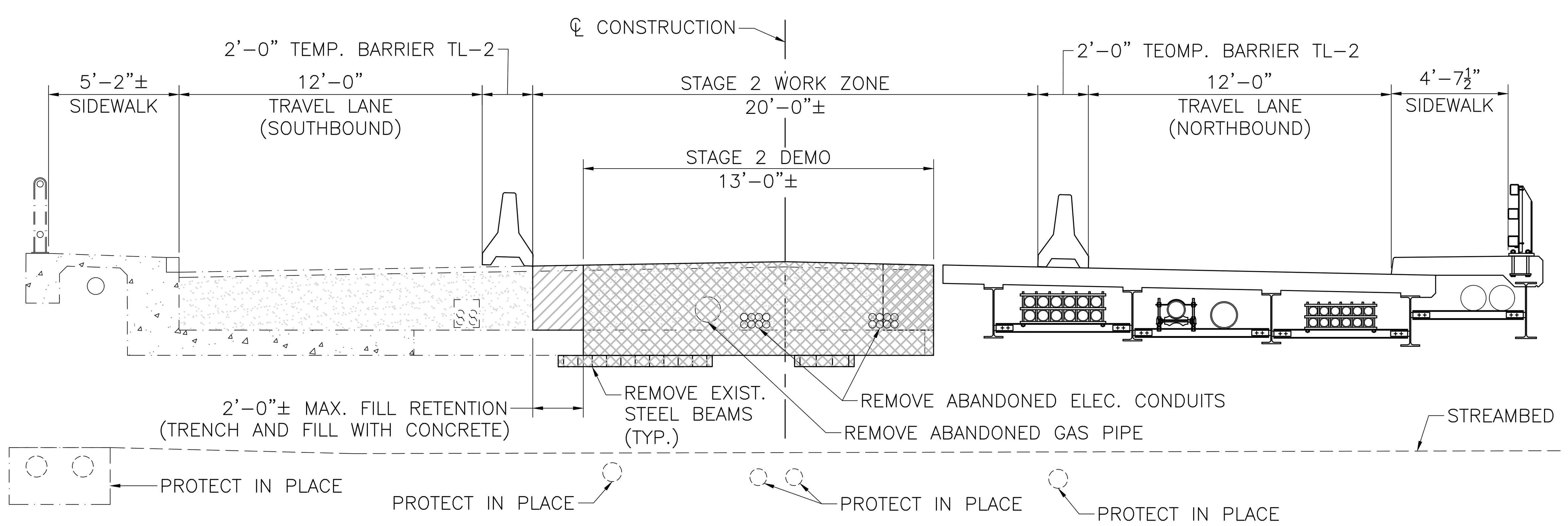
STAGE 2 – CONSTRUCTION



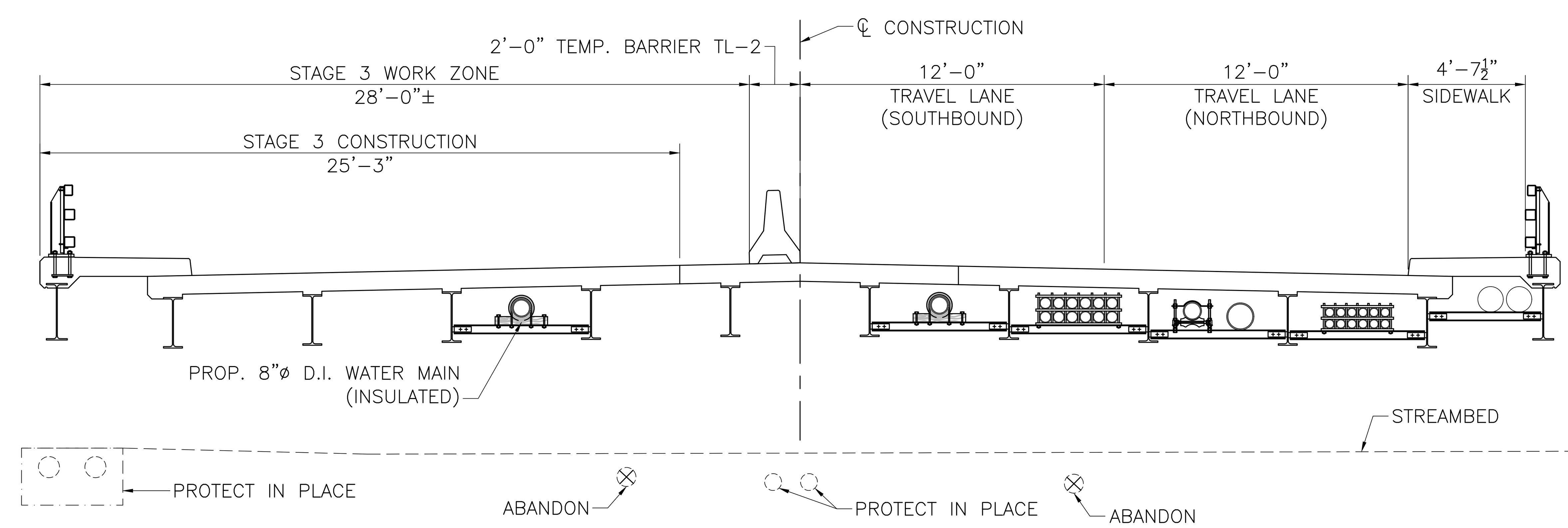
STAGE 1 – CONSTRUCTION



STAGE 3 – DEMOLTION



STAGE 2 – DEMOLITION



STAGE 3 – CONSTRUCTION

NOTES:
1. WATER UTILITY RELOCATIONS BY TOWN OF ARLINGTON.
2. TEMPORARY UTILITY SUPPORTS BY OTHERS.
3. ALL OTHER UTILITY RELOCATIONS BY OTHERS.

CONSTRUCTION STAGING

SCALE: ¼" = 1'-0"

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PROPOSED BRIDGE REPLACEMENT
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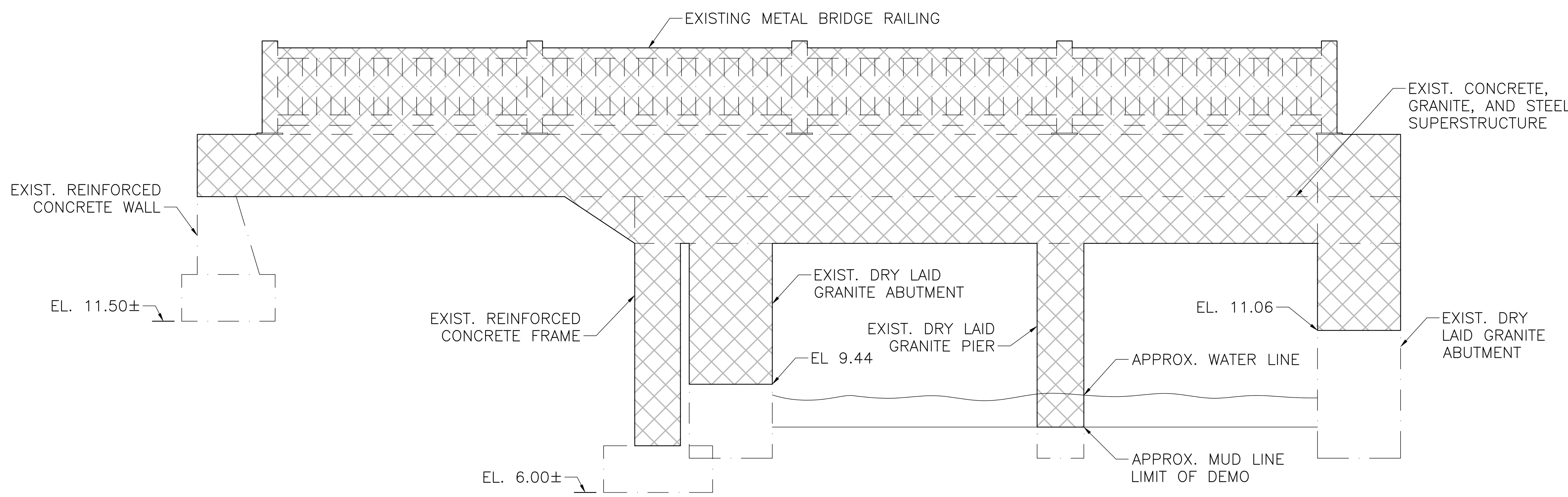
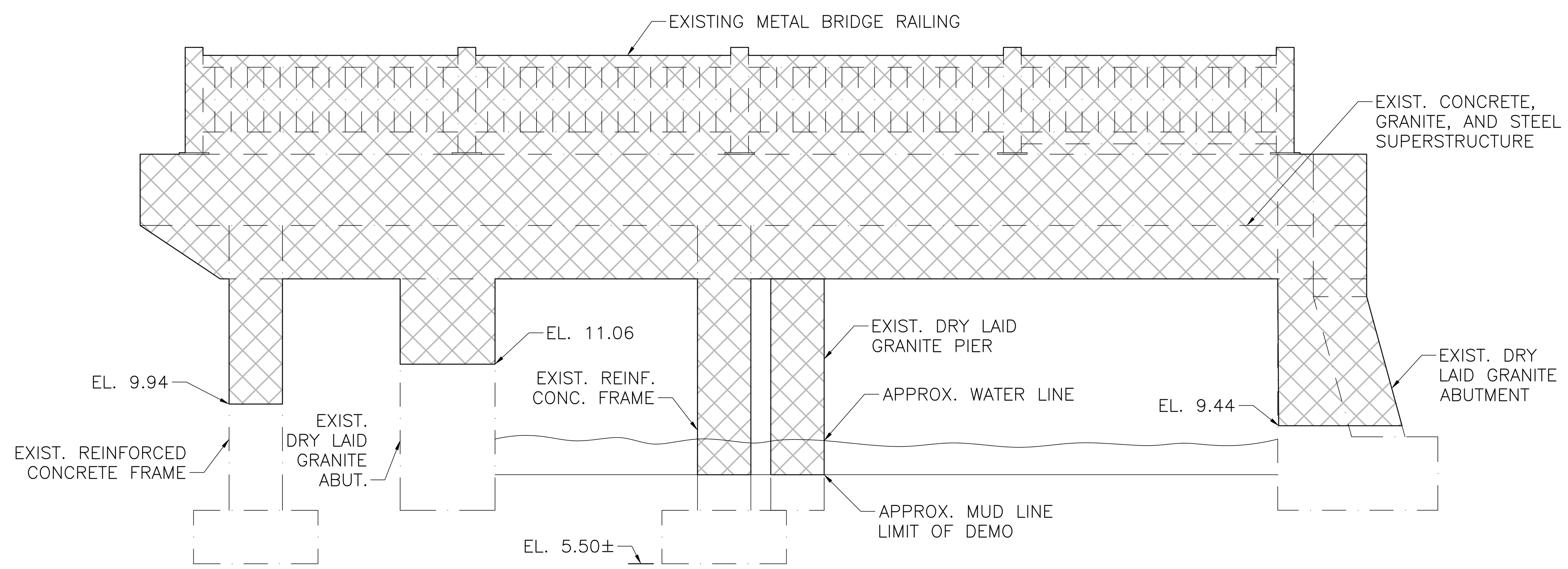
US3 (MYSTIC STREET) OVER MILL BROOK

CONSTRUCTION STAGING

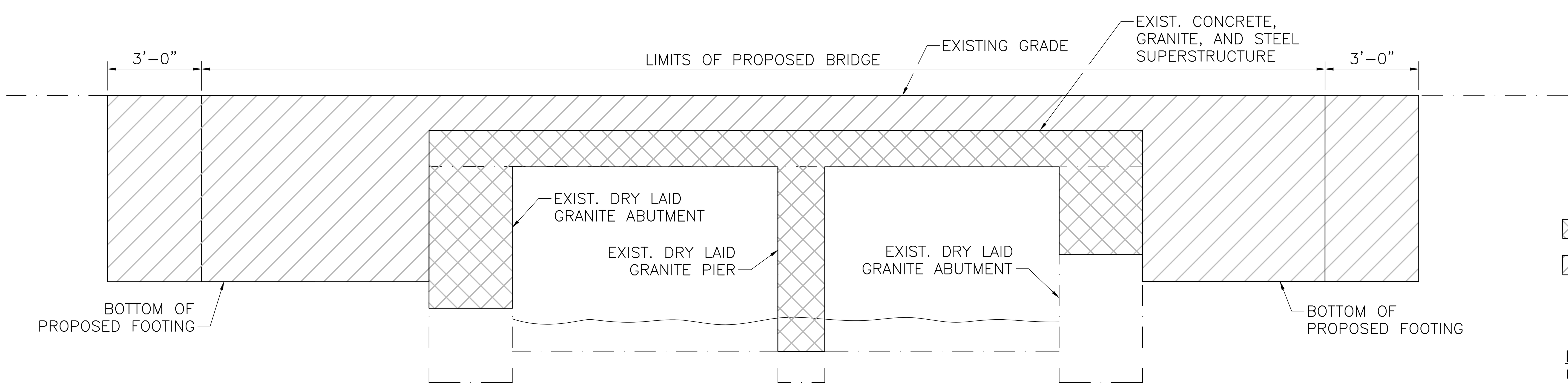
SHEET 6 OF 25



EAST ELEVATION



WEST ELEVATION



LONGITUDINAL SECTION

APPROXIMATE LIMITS OF DEMOLITION

APPROXIMATE LIMITS OF BRIDGE EXCAVAVTION

NOTE:
UTILITIES NOT SHOWN. SEE CONSTRUCTION STAGING SECTIONS AND UTILITY PLAN.

LIMITS OF DEMOLITION

SCALE: 3/8" = 1'-0"

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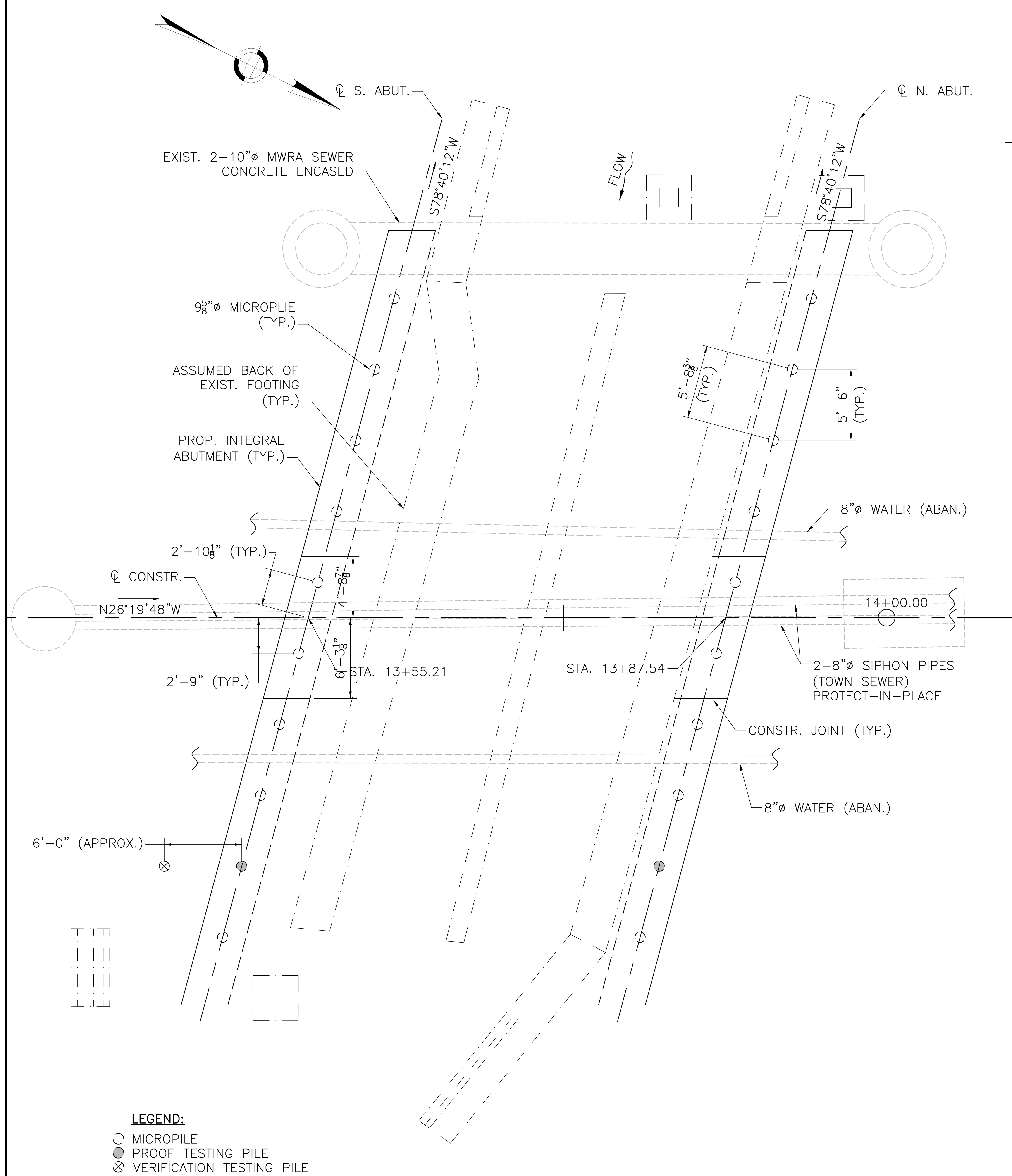
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

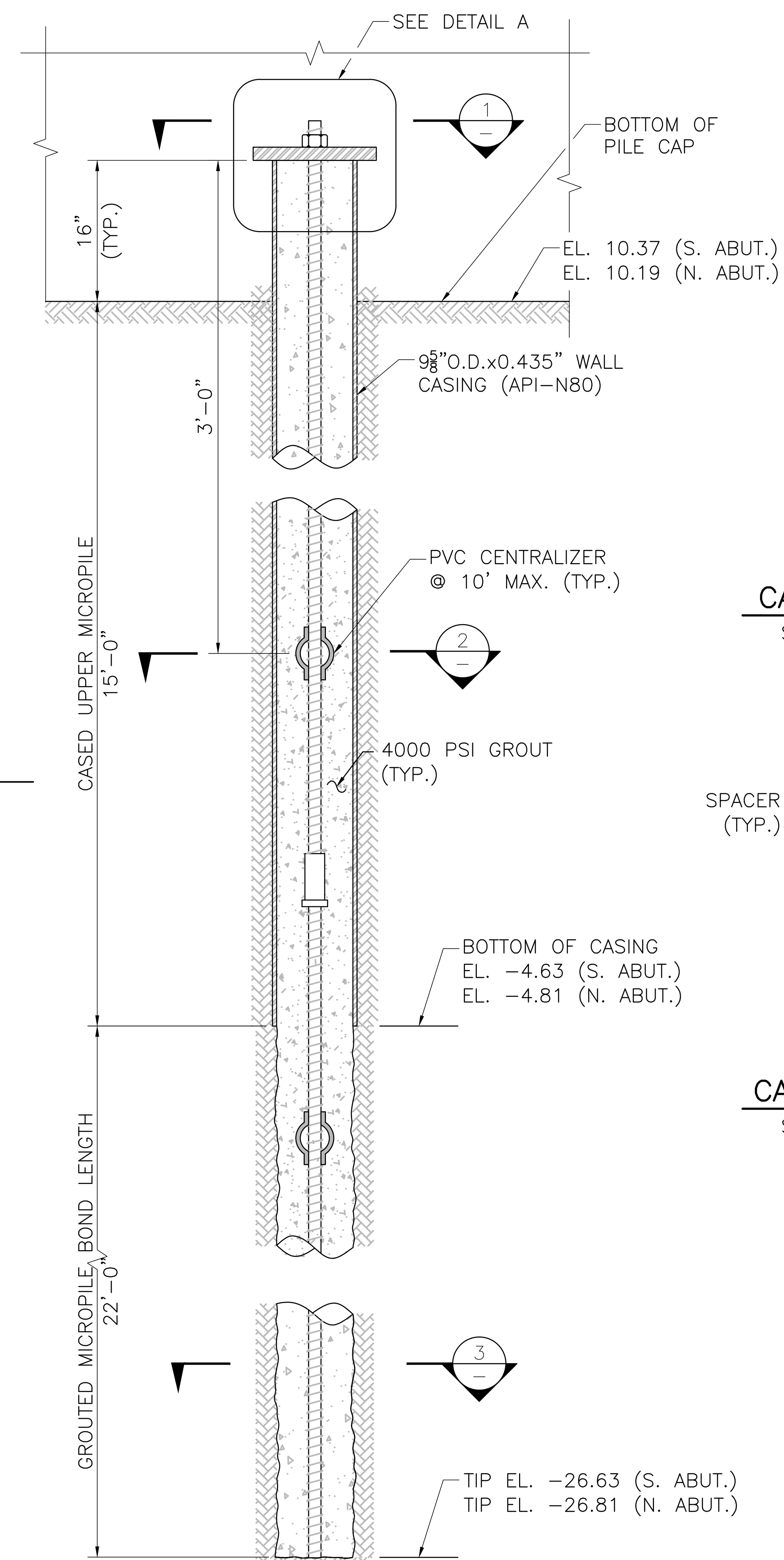
DEMOLITION DETAILS

SHEET 7 OF 25



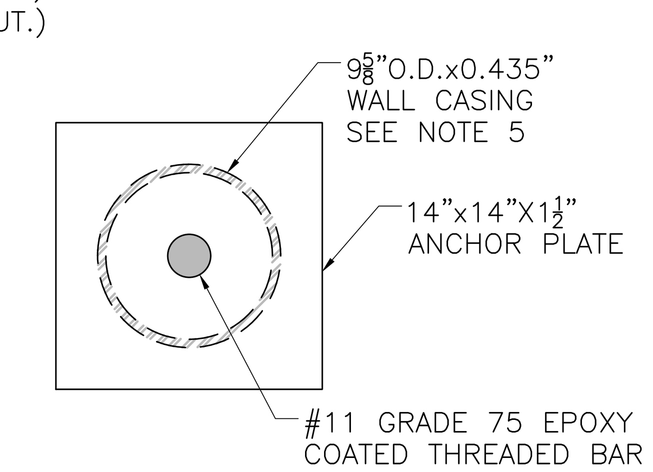
FOUNDATION PLAN

SCALE: 3/16" = 1'-0"



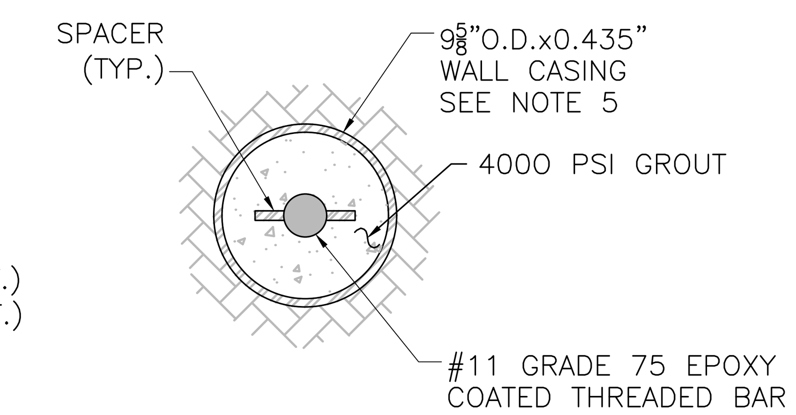
MICROPILE DETAILS

SCALE: 1" = 1'-0"



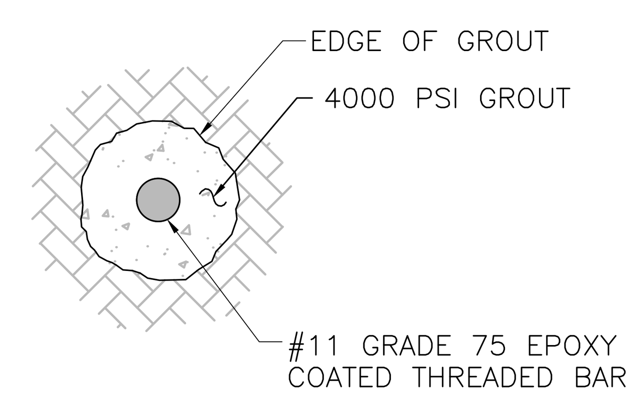
CASED SECTION 1

SCALE: 1½" = 1'-0"



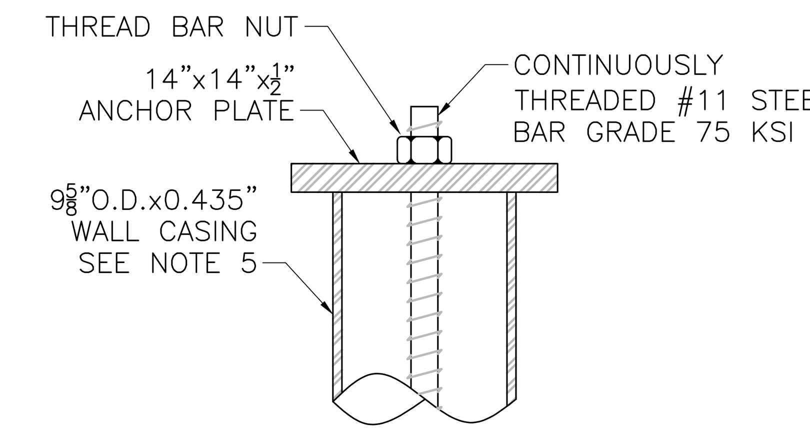
CASED SECTION 2

SCALE: 1½" = 1'-0"



UNCASED SECTION 3

SCALE: 1½" = 1'-0"



DETAIL A

SCALE: 1½" = 1'-0"

MICROPILE NOTES:

1. THE FACTORED AXIAL DESIGN LOAD PER MICROPILE IS 80.4 KIPS AS PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS STRENGTH I LOAD COMBINATION.
2. THE FACTORED STRUCTURAL RESISTANCE PER MICROPILE IS 134.0 KIPS AND IS THE PRODUCT OF THE NOMINAL STRUCTURAL RESISTANCE OF 178.7 KIPS AND A RESISTANCE FACTOR OF 0.75.
3. THE FACTORED GEOTECHNICAL PILE RESISTANCE IS 90.1 KIPS AND IS THE PRODUCT OF THE NOMINAL GEOTECHNICAL RESISTANCE OF 163.9 KIPS AND A RESISTANCE OF 0.55.
4. THE ESTIMATED TIP ELEVATION IS –26.63 FEET AT SOUTH ABUTMENT AND –26.81 FEET AT NORTH ABUTMENT.
5. STEEL CASING SHALL BE PRIME STEEL AND MEET THE REQUIREMENTS OF API 5L PSL1 GRADE 52 KSI WITH SR 15 SUPPLEMENTAL REQUIREMENTS.
6. REINFORCEMENT BAR SHALL BE CONTINUOUSLY THREADED FOR THE ENTIRE BAR LENGTH CONFORMING TO ASTM A615, HAVING MINIMUM YIELD STRENGTH OF 75 KSI.
7. THREAD BAR NUT AND COUPLING FROM THE SAME MANUFACTURER AS THE THREAD BAR SHALL CONFORM TO THREAD BAR MANUFACTURER REQUIREMENTS.
8. BAR COUPLING SHALL BE FULL ENGAGEMENT BAR COUPLER. BAR COUPLING SHALL NOT BE LOCATED WITHIN THE TOP THIRD OF THE PILE LENGTH.
9. ANCHOR PLATE SHALL MEET REQUIREMENTS OF ASTM M270 GRADE 50.
10. GROUT SHALL HAVE A MINIMUM OF 28–DAY COMPRESSIVE STRENGTH OF 4,000 PSI AND BE IN ACCORDANCE WITH ASTM C109.
11. GROUT SHALL BE PLACED USING TREMIE METHODS.
12. THE CONTRACTOR SHALL SUBMIT A MICROPILE SCHEDULE, MICROPILE INSTALLATION, AND MICROPILE TESTING PLAN FOR REVIEW AND APPROVAL OF THE ENGINEER.
13. SEE SPECIAL PROVISION ITEM 945.10 DRILLED MICROPILES, ITEM 948.60 MICROPILE VERIFICATION LOAD TEST, AND ITEM 948.61 MICROPILE PROOF LOAD TEST FOR ADDITIONAL MICROPILE SPECIFICATIONS.

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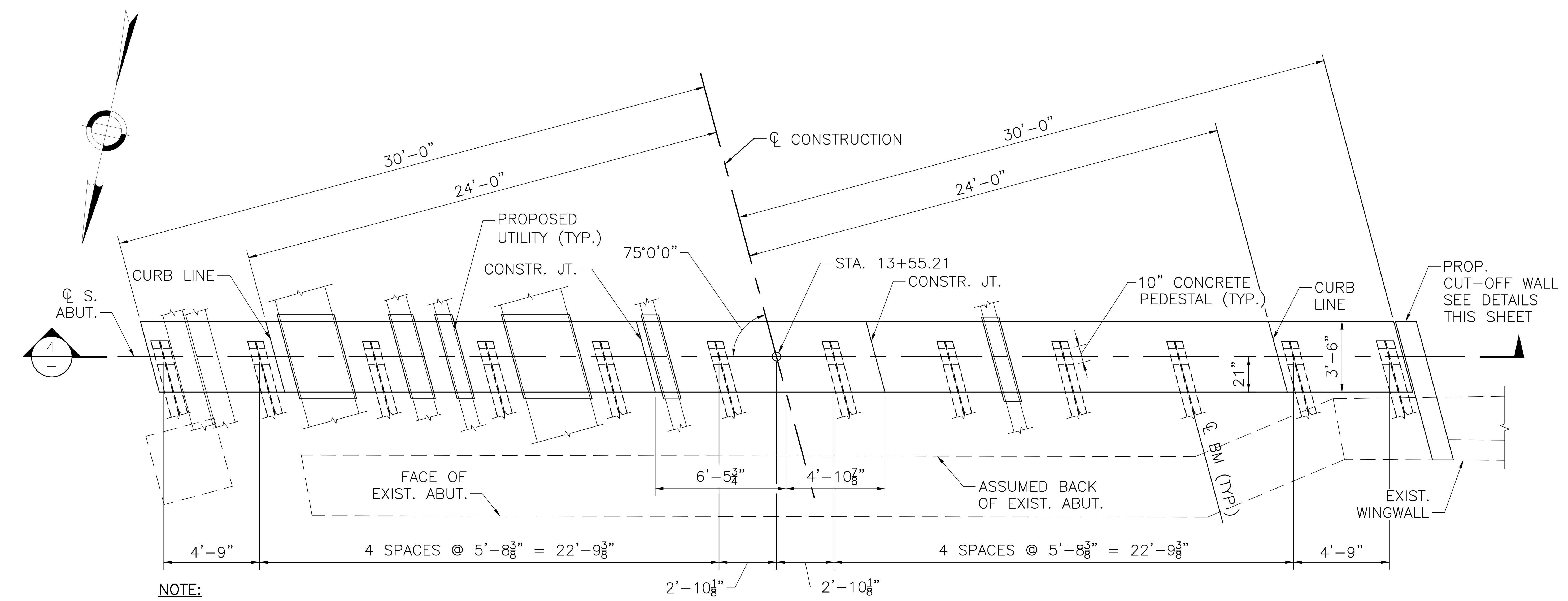
PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

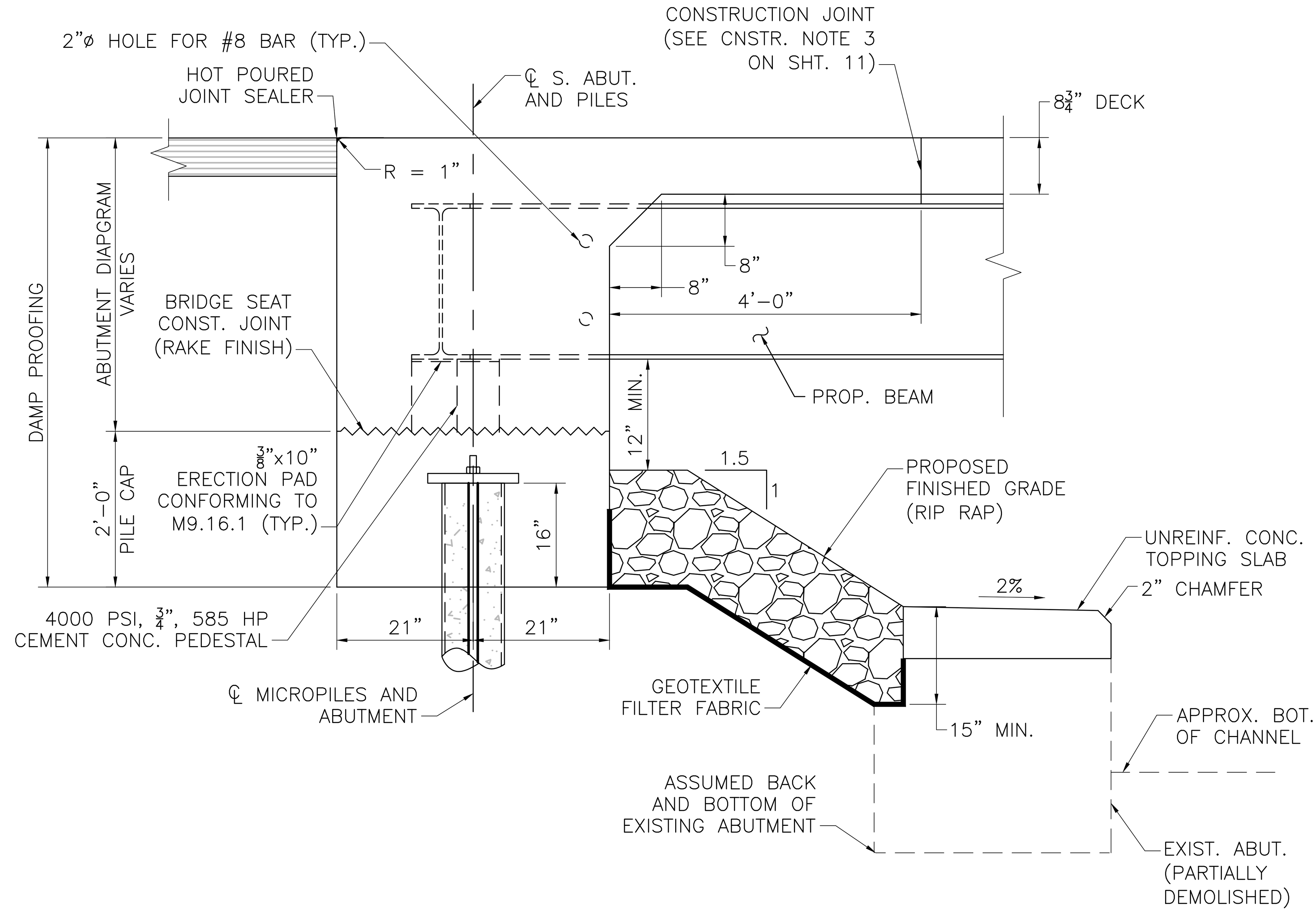
FOUNDATION PLAN & MICROPILE DETAILS

SHEET 8 OF 25

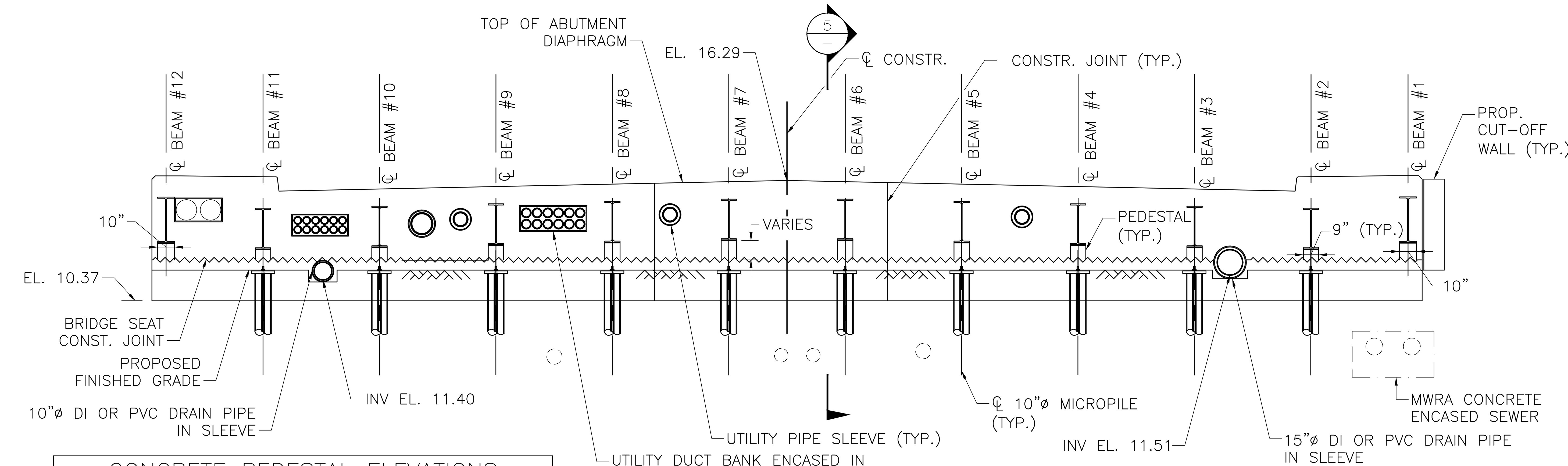


NOTE:
SEE SHEET 6 FOR UTILITY IDENTIFICATION

SOUTH ABUTMENT PLAN
SCALE: ¼" = 1'-0"



SECTION 5
SCALE: ¾" = 1'-0"

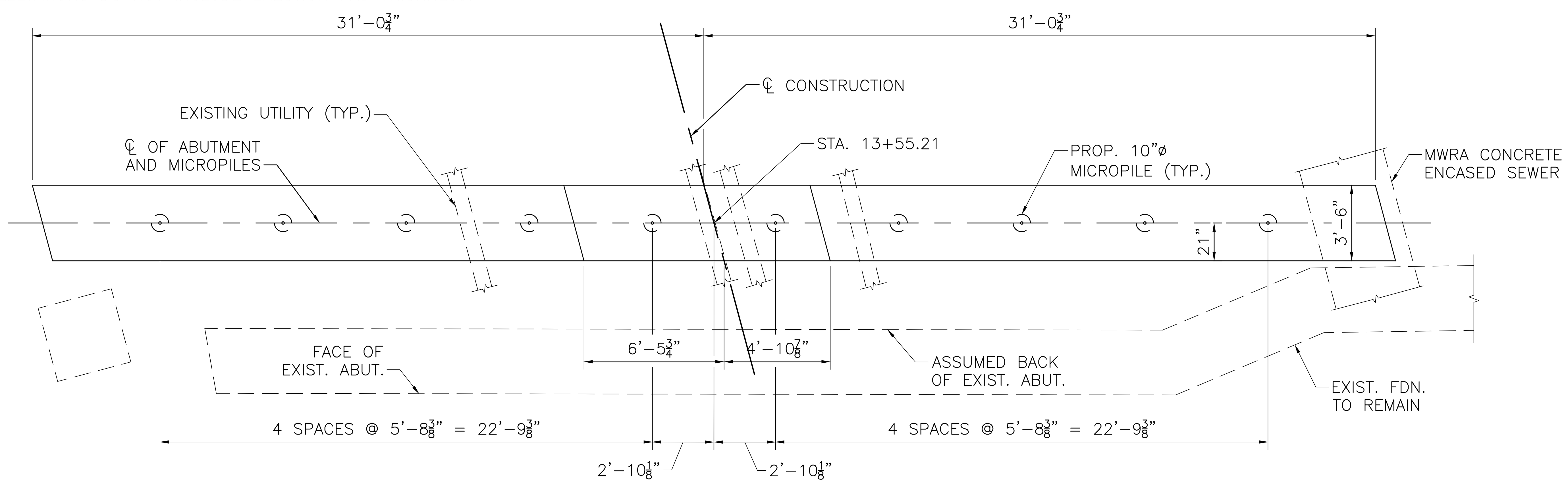


SECTION 4
SCALE: ¼" = 1'-0"

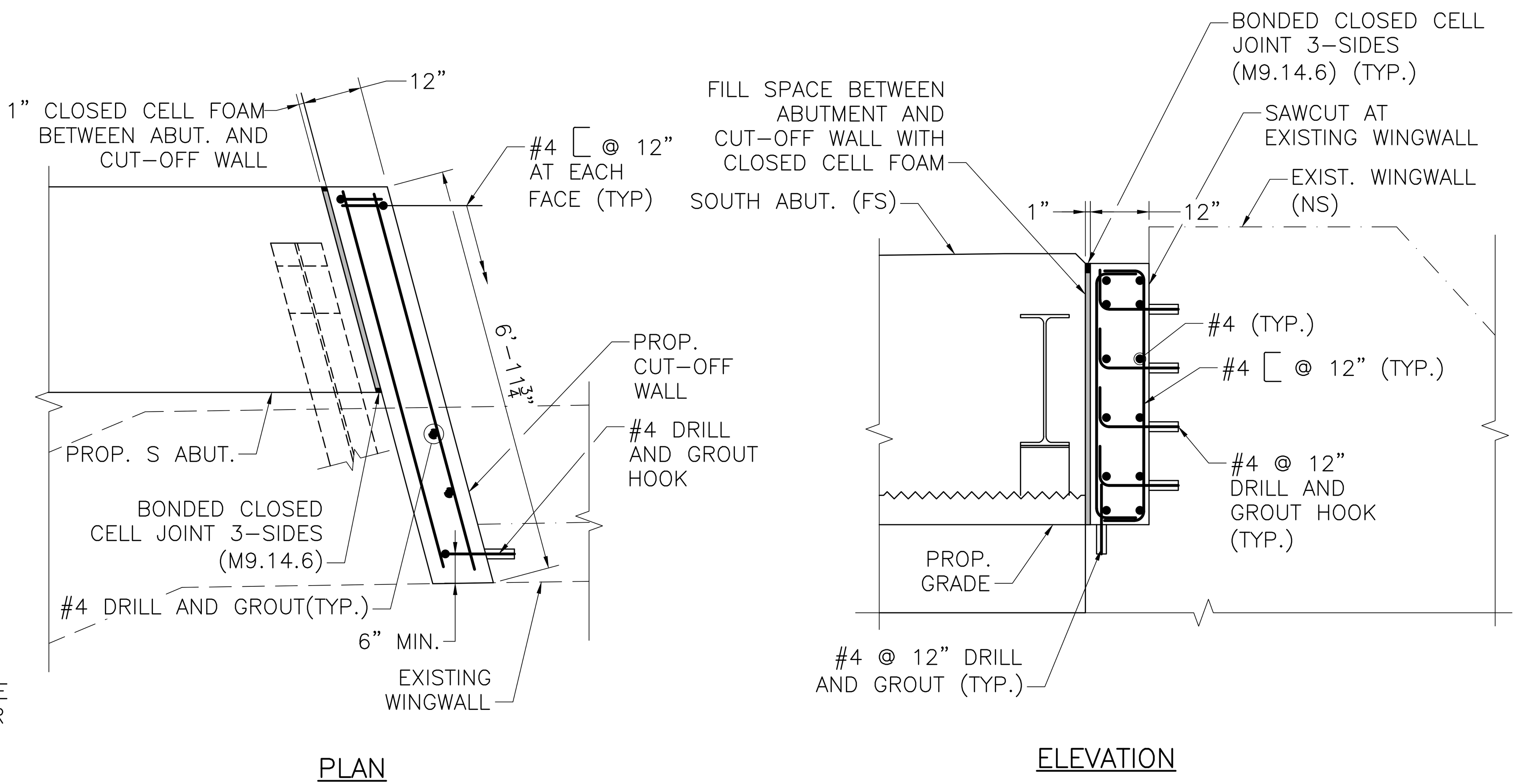
CONCRETE PEDESTAL ELEVATIONS

BEAM 1	BEAM 2	BEAM 3	BEAM 4	BEAM 5	BEAM 6
13.17	12.87	12.99	13.11	13.23	13.36
BEAM 7	BEAM 8	BEAM 9	BEAM 10	BEAM 11	BEAM 12
13.36	13.26	13.15	13.04	12.94	13.26

NOTE: ELEVATIONS DO NOT INCLUDE ERECTION PAD THICKNESS.



SOUTH ABUTMENT – FOUNDATION PLAN
SCALE: ¼" = 1'-0"



SOUTH ABUTMENT – CUT-OFF WALL DETAILS
SCALE: ½" = 1'-0"

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BRIDGE REPLACEMENT
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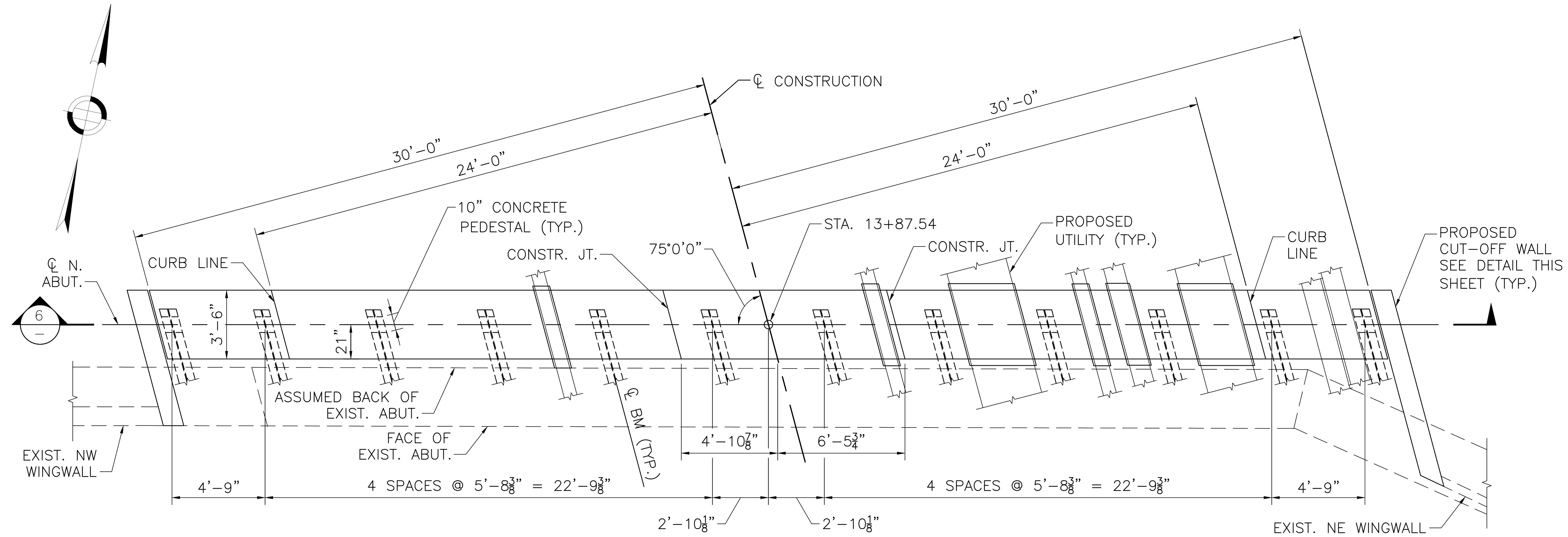
PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

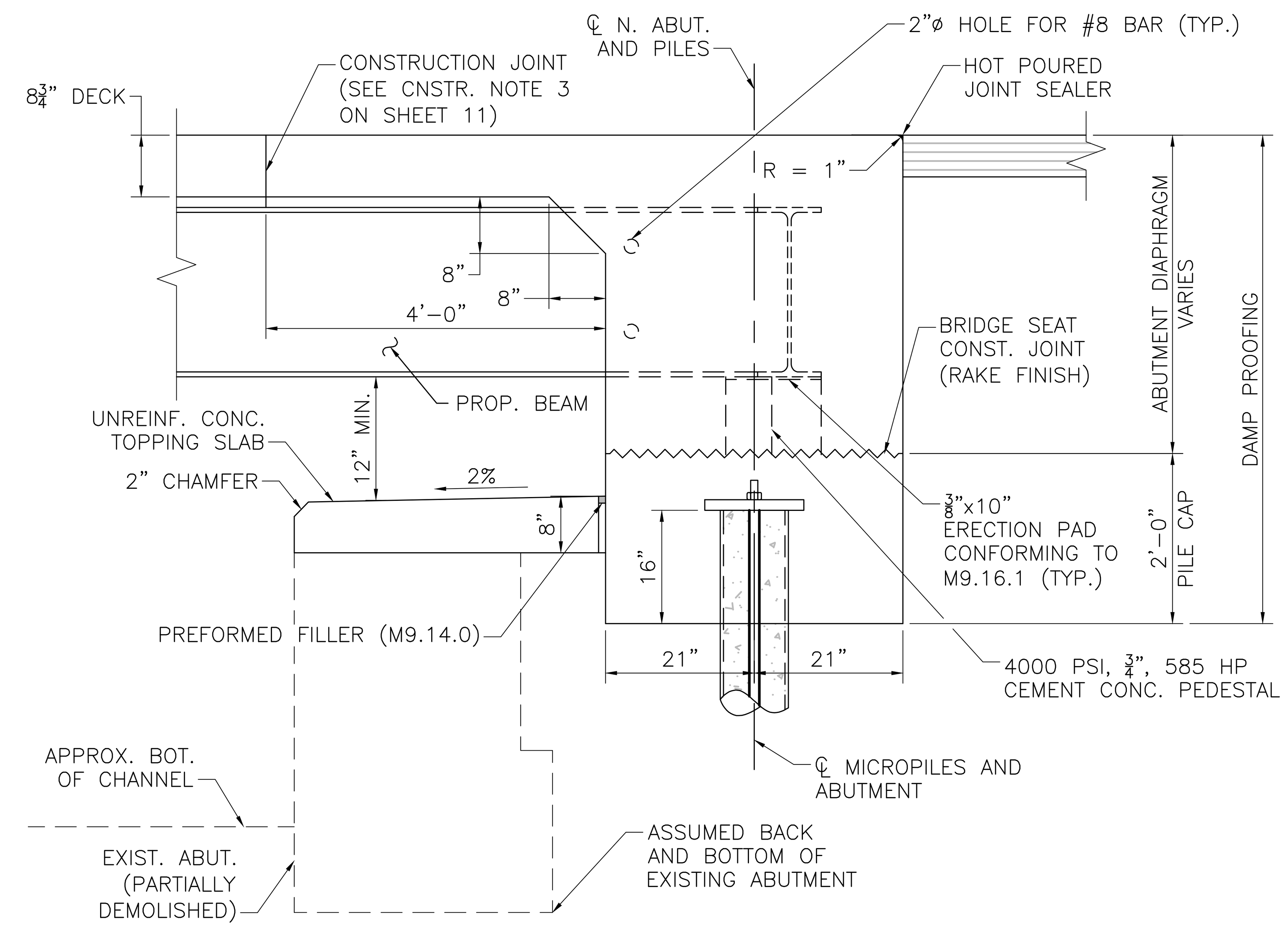
SOUTH
ABUTMENT

SHEET 9 OF
25

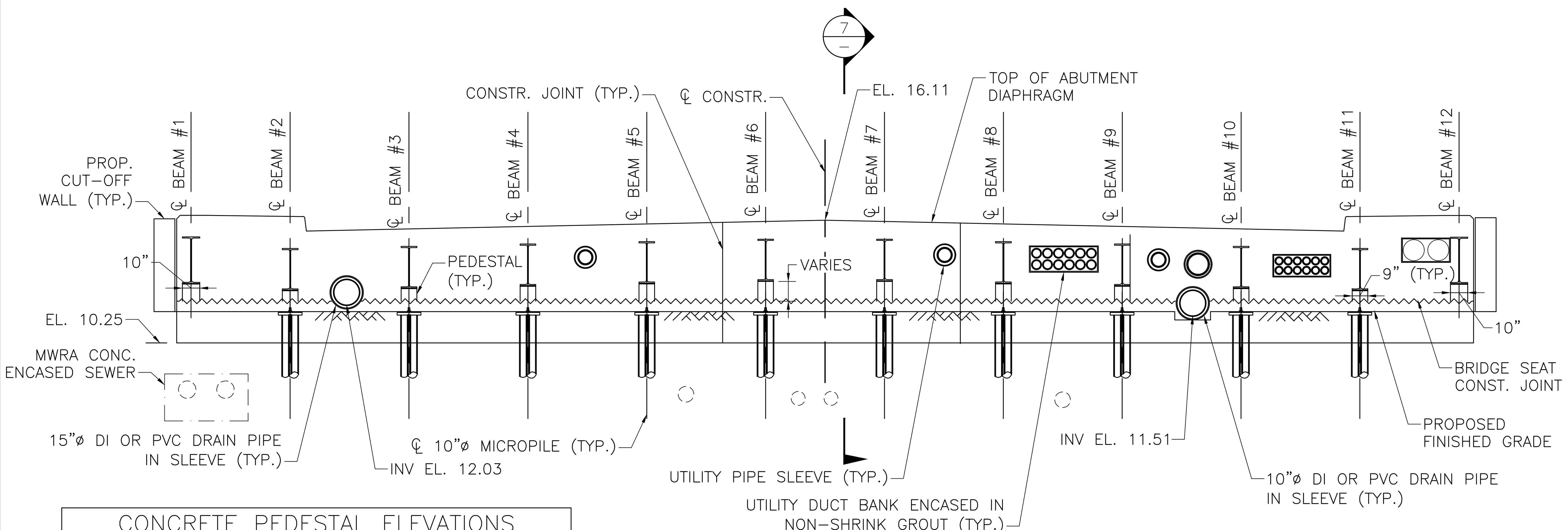


NOTE:
SEE SHEET 6 FOR UTILITY IDENTIFICATION

NORTH ABUTMENT PLAN
SCALE: ¼" = 1'-0"



SECTION 7
SCALE: ¾" = 1'-0"

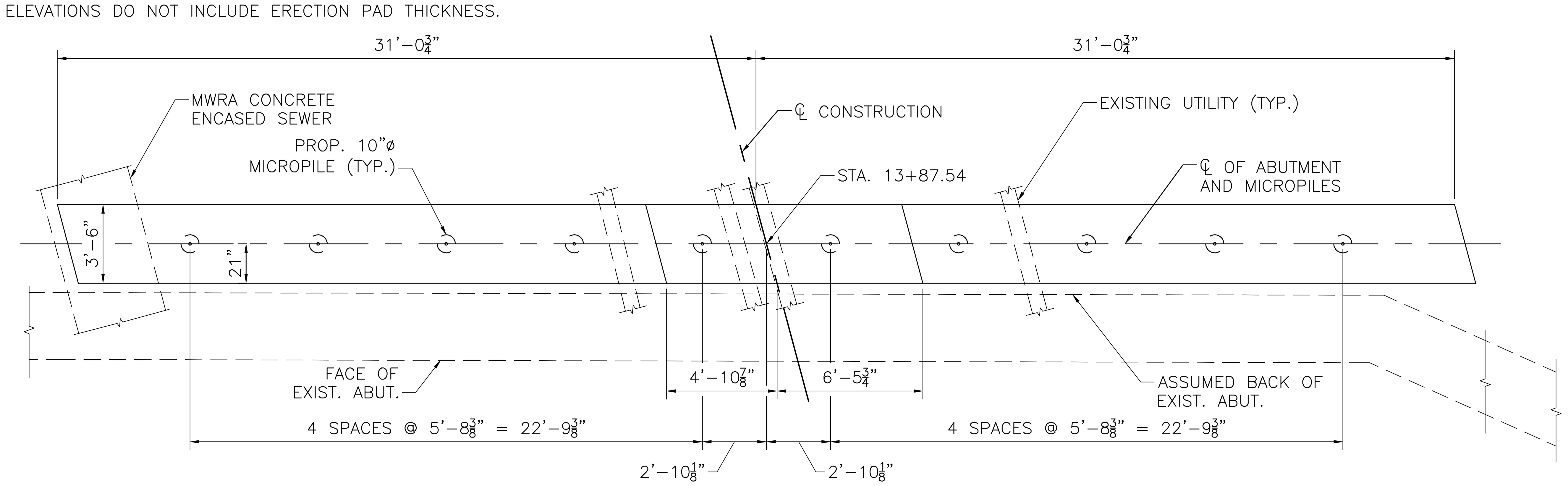


SECTION 6
SCALE: ¼" = 1'-0"

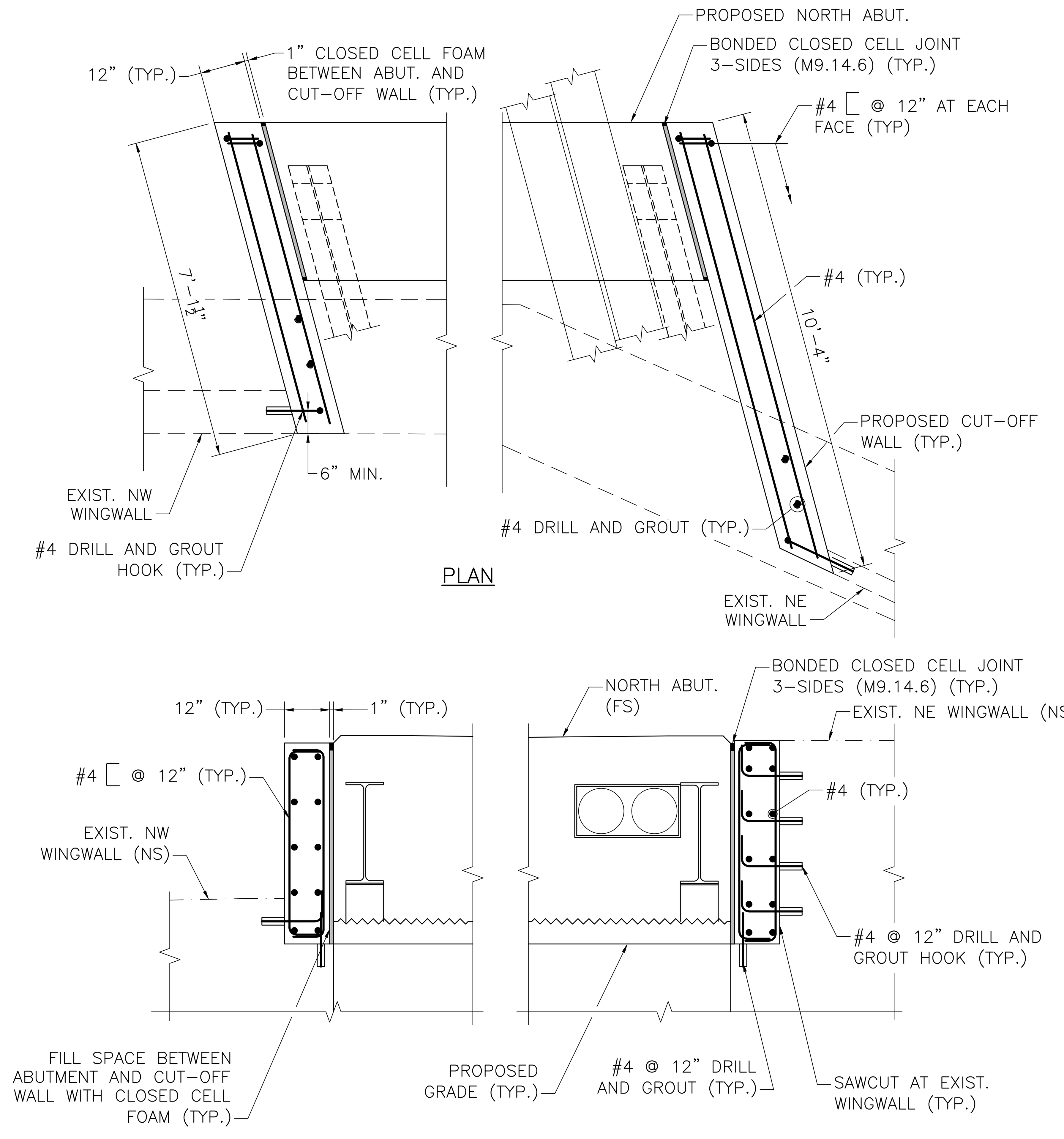
CONCRETE PEDESTAL ELEVATIONS

BEAM 1	BEAM 2	BEAM 3	BEAM 4	BEAM 5	BEAM 6
12.99	12.69	12.81	12.93	13.06	13.18
BEAM 7	BEAM 8	BEAM 9	BEAM 10	BEAM 11	BEAM 12
13.19	13.08	12.97	12.87	12.76	13.08

NOTE: ELEVATIONS DO NOT INCLUDE ERECTION PAD THICKNESS.



NORTH ABUTMENT – FOUNDATION PLAN
SCALE: ¼" = 1'-0"



NORTH ABUTMENT – CUT-OFF WALL DETAILS
SCALE: ½" = 1'-0"

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TOWN OF ARLINGTON
PROPOSED BRIDGE REPLACEMENT
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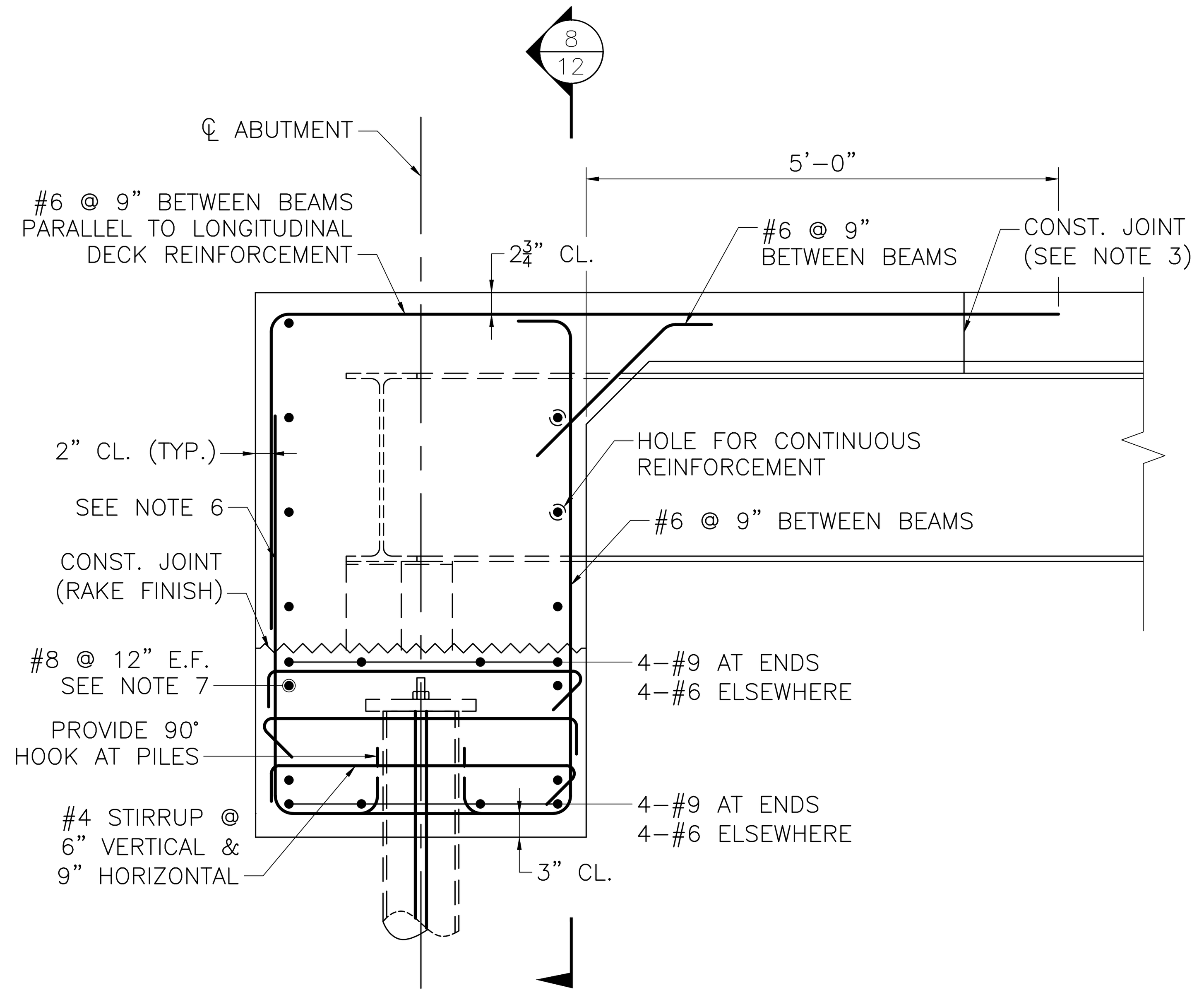
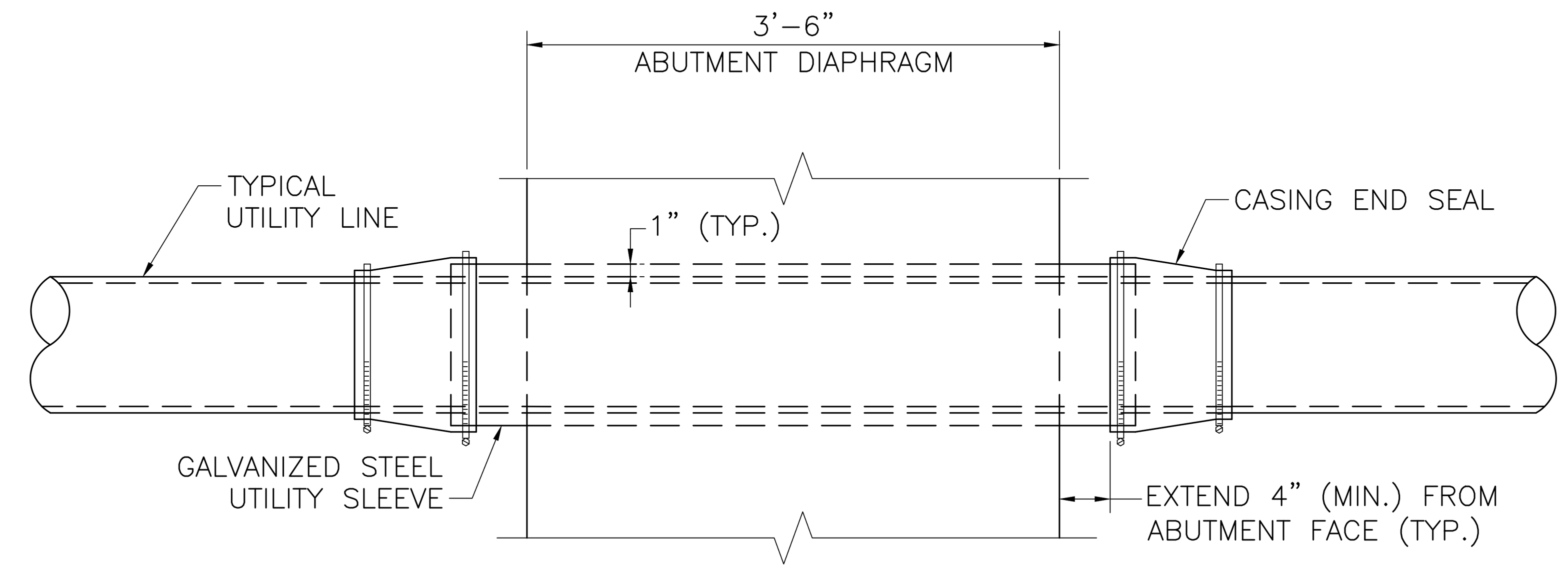
US3 (MYSTIC STREET) OVER MILL BROOK

NORTH ABUTMENT

SHEET 10 OF 25



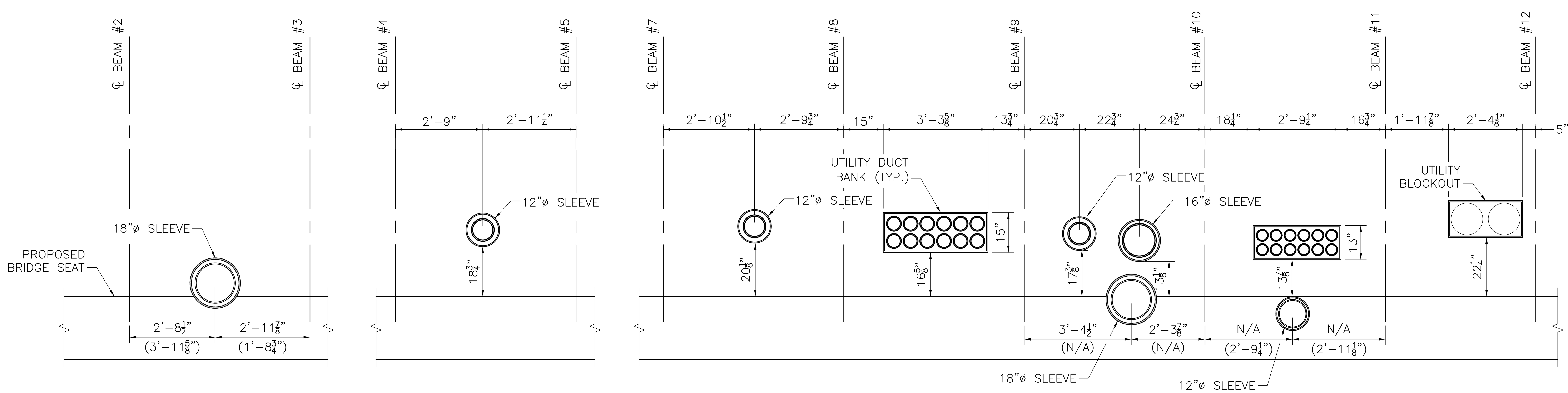
TYPICAL ABUTMENT REINFORCEMENT
SCALE: ¾" = 1'-0"



UTILITY SLEEVE DETAILS
SCALE: 1" = 1'-0"

CONSTRUCTION NOTES:

1. ALL REINFORCEMENT SHALL BE COATED.
2. DECK SLAB REINFORCEMENT NOT SHOWN FOR CLARITY. CONTINUE DECK SLAB REINFORCEMENT TO BACK OF ABUTMENT.
3. THE CONTRACTOR SHALL FOLLOW THE DECK PLACEMENT SEQUENCE AS SHOWN ON THESE CONSTRUCTION DRAWINGS.
4. ALL CONCRETE SHALL CONTAIN SUPERPLASTICIZER TO ENSURE ADEQUATE CONSOLIDATION.
5. BOTH ABUTMENTS SHALL BE BACKFILLED SIMULTANEOUSLY. NO MORE THAN TWO (2) FEET OF DIFFERENTIAL BACKFILL HEIGHT SHALL BE PERMITTED. BACKFILLING SHALL NOT BEGIN UNTIL THE ABUTMENT AND DECK CONSTRUCTION IS COMPLETE.
6. THE CONTRACTOR MAY USE MECHANICAL REINFORCING BAR SPLICERS IN LIEU OF TENSION LAP SPLICES TO FACILITATE CONSTRUCTION. HOWEVER, NO ADDITIONAL COMPENSATION WILL BE PROVIDED FOR THE USE OF MECHANICAL REINFORCING BAR SPLICERS. MECHANICAL REINFORCING BAR SPLICERS SHALL BE INSTALLED TO MAKE THIS REINFORCEMENT CONTINUOUS.
7. MECHANICAL REINFORCING BAR SPLICERS SHALL BE INSTALLED AT STAGE CONSTRUCTION JOINTS FOR ALL TRANSVERSE REINFORCEMENT.



NOTE:
DIMENSIONS SHOWN FOR NORTH ABUTMENT, SOUTH ABUTMENT SIMILAR EXCEPT AS NOTED IN PARENTHESES.

UTILITY DETAILS AT ABUTMENT
SCALE: ½" = 1'-0"

UTILITY NOTES:

1. UTILITY SLEEVES SHALL BE STEEL PIPE CONFORMING TO ASTM A-53, TYPE S, GRADE B, STANDARD WEIGHT, PLAIN ENDS, HOT-DIP GALVANIZED AND SHALL BE SET IN THE FORMS PRIOR TO PLACING ABUTMENT DIAPHRAGM CONCRETE.
2. ALL VOID SPACE WITHIN EACH ABUTMENT UTILITY BLOCKOUT SHALL BE FILLED WITH GROUT. THE GROUT SHALL BE LISTED ON THE MASSDOT QUALIFIED CONSTRUCTION MATERIALS PRODUCT LIST.

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A-10-015 (C10)
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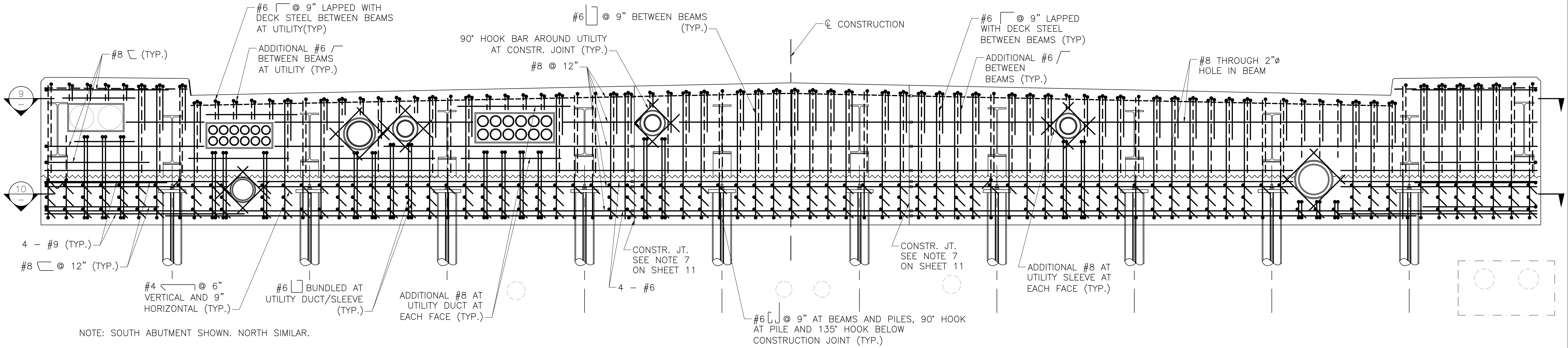
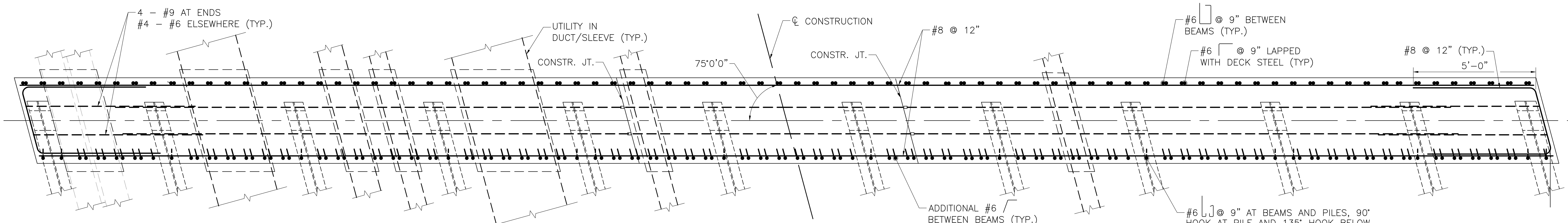
ABUTMENT DETAILS (1 OF 2)

SHEET 11 OF 25



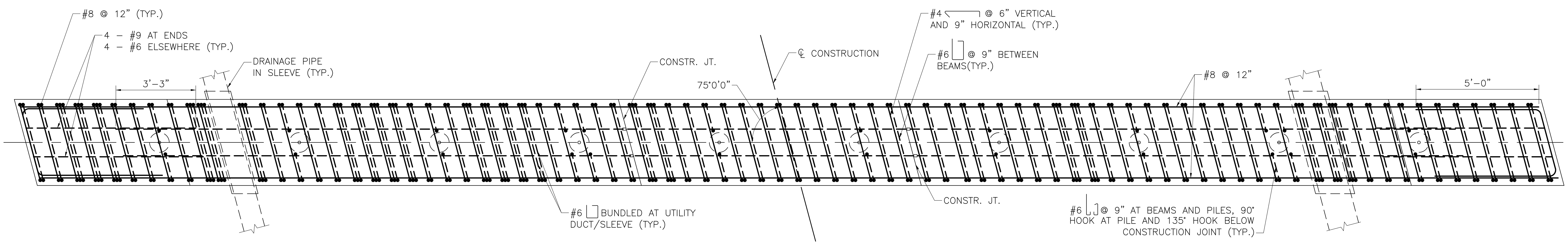
NOTE: SOUTH ABUTMENT SHOWN. NORTH SIMILAR.

SECTION 8/11
SCALE: ½" = 1'–0"



NOTE: SOUTH ABUTMENT SHOWN. NORTH SIMILAR.

SECTION 9/–
SCALE: ½" = 1'–0"



NOTE: SOUTH ABUTMENT SHOWN. NORTH SIMILAR.

SECTION 10/–
SCALE: ½" = 1'–0"

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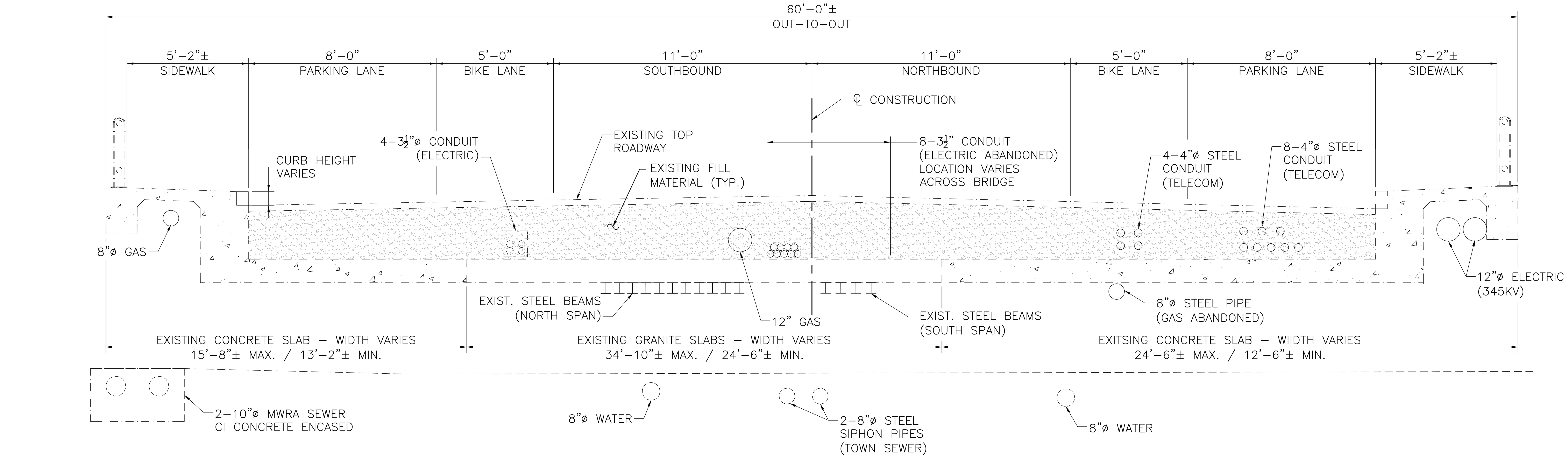
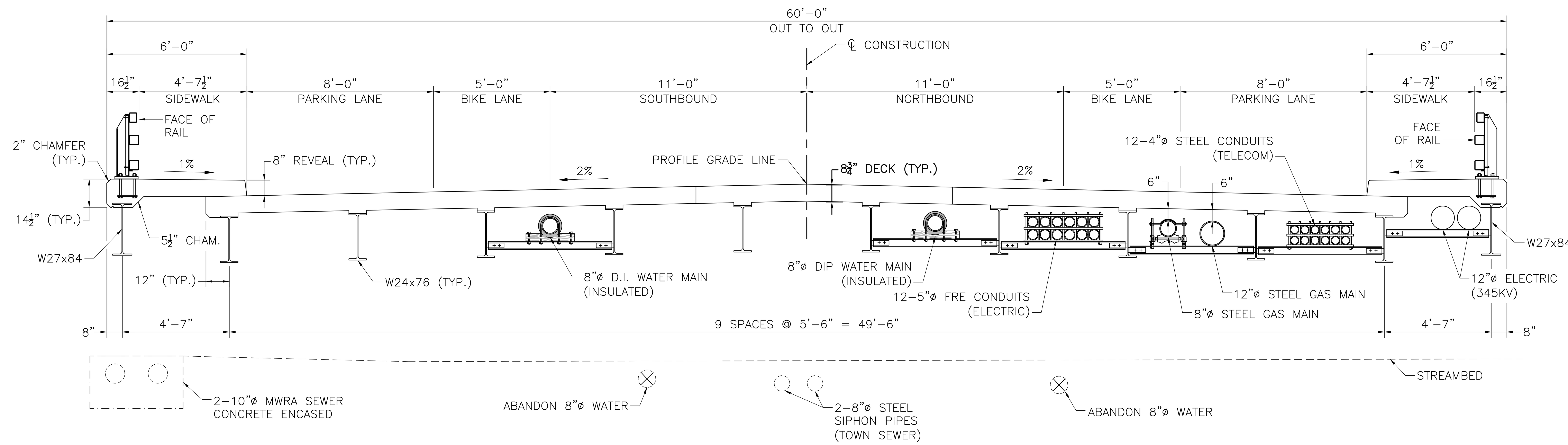
ABUTMENT DETAILS (2 OF 2)

SHEET 12 OF 25



EXISTING CROSS SECTION

SCALE: ⅜" = 1'-0"



PROPOSED CROSS SECTION

SCALE: ⅜" = 1'-0"

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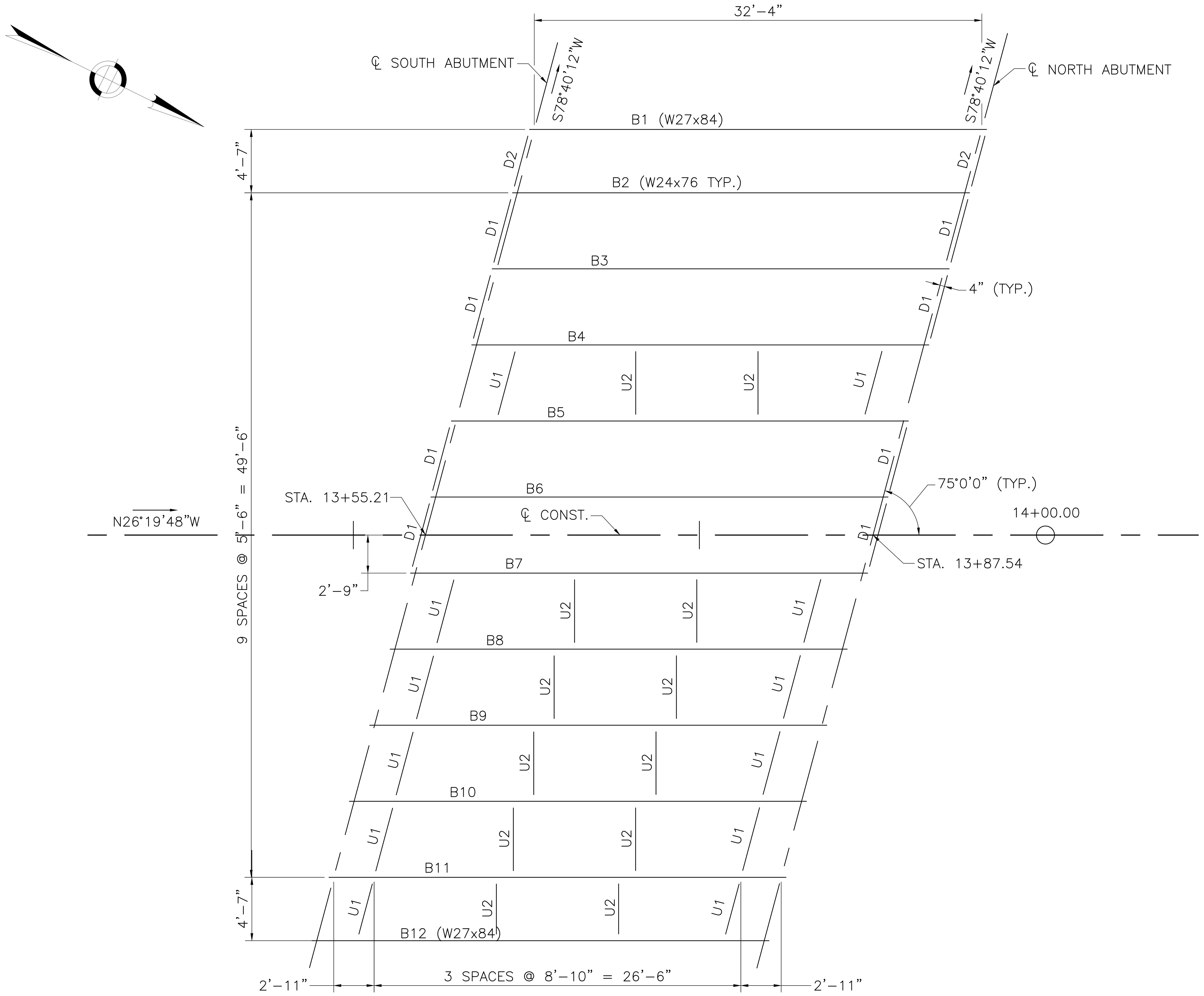
BRIDGE REPLACEMENT

TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

CROSS SECTIONS

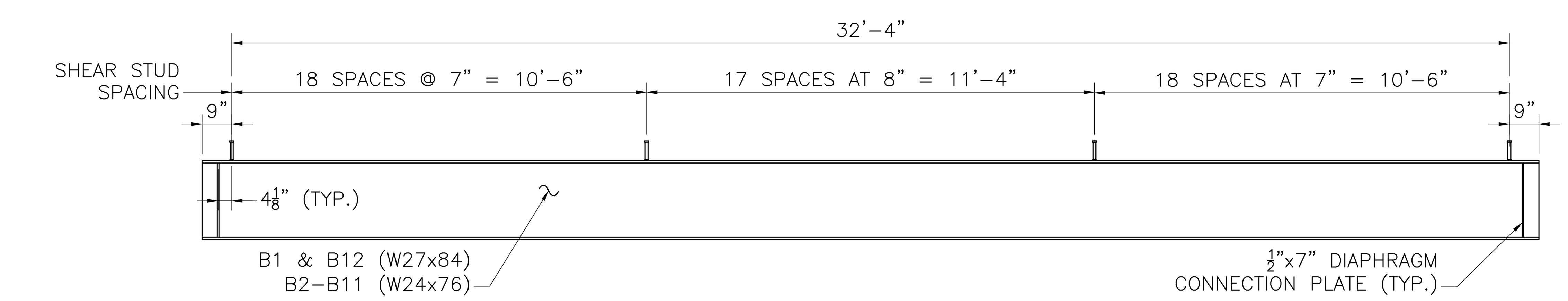
SHEET 13 OF 25



FRAMING PLAN

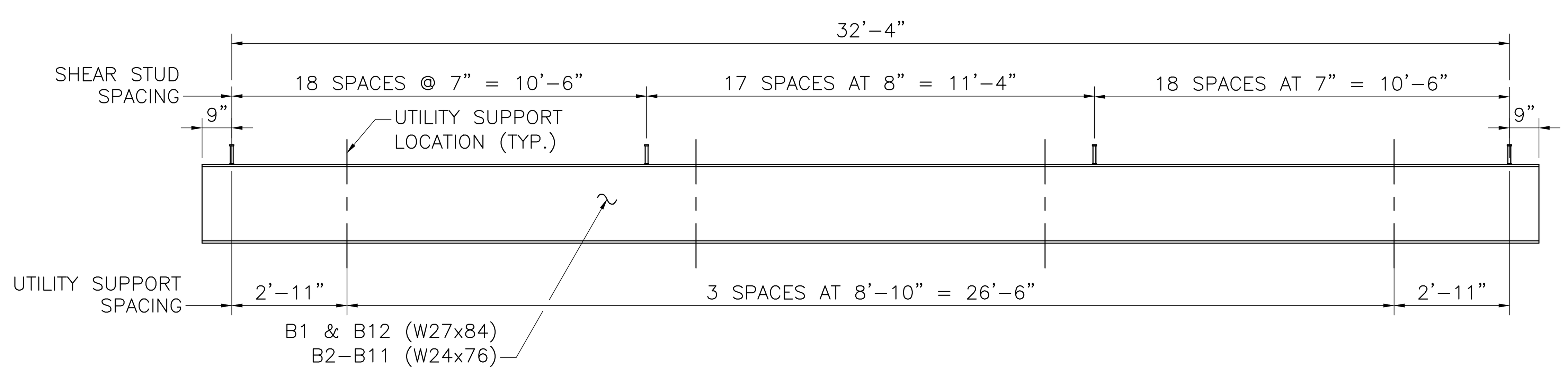
SCALE: $\frac{1}{16}$" = 1'-0"

CAMBER TABLE (INCHES)												
STRINGER NO.		SPAN NO. 1										
		℄ BRG. S. ABUT.	0.1L	0.2L	0.3L	0.4L	0.5L	0.6L	0.7L	0.8L	0.9L	℄ BRG. N. ABUT.
B1 – B2	STEEL DL DEFLECTION	0.000	0.010	0.018	0.025	0.029	0.031	0.029	0.025	0.018	0.010	0.000
	CONC. DL DEFLECTION	0.000	0.054	0.102	0.139	0.163	0.171	0.163	0.139	0.102	0.054	0.000
	S.D.L. DEFLECTION	0.000	0.006	0.011	0.015	0.018	0.019	0.018	0.015	0.011	0.006	0.000
	VERT. CURVE CAMBER	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ADDITIONAL CAMBER	0.000	0.127	0.240	0.329	0.385	0.404	0.385	0.329	0.240	0.127	0.000
	TOTAL CAMBER	0.000	0.196	0.371	0.508	0.595	0.625	0.595	0.508	0.371	0.196	0.000
B3 – B10	STEEL DL DEFLECTION	0.000	0.044	0.084	0.115	0.135	0.142	0.135	0.115	0.084	0.044	0.000
	CONC. DL DEFLECTION	0.000	0.077	0.147	0.201	0.235	0.247	0.235	0.201	0.147	0.077	0.000
	S.D.L. DEFLECTION	0.000	0.002	0.004	0.005	0.006	0.007	0.006	0.005	0.004	0.002	0.000
	VERT. CURVE CAMBER	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ADDITIONAL CAMBER	0.000	0.127	0.240	0.329	0.385	0.404	0.385	0.329	0.240	0.127	0.000
	TOTAL CAMBER	0.000	0.251	0.475	0.650	0.761	0.799	0.761	0.650	0.475	0.251	0.000
B11 – B12	STEEL DL DEFLECTION	0.000	0.041	0.077	0.106	0.124	0.130	0.124	0.106	0.077	0.041	0.000
	CONC. DL DEFLECTION	0.000	0.054	0.102	0.139	0.163	0.171	0.163	0.139	0.102	0.054	0.000
	S.D.L. DEFLECTION	0.000	0.006	0.011	0.015	0.018	0.019	0.018	0.015	0.011	0.006	0.000
	VERT. CURVE CAMBER	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	ADDITIONAL CAMBER	0.000	0.127	0.240	0.329	0.385	0.404	0.385	0.329	0.240	0.127	0.000
	TOTAL CAMBER	0.000	0.227	0.430	0.589	0.690	0.724	0.690	0.589	0.430	0.227	0.000



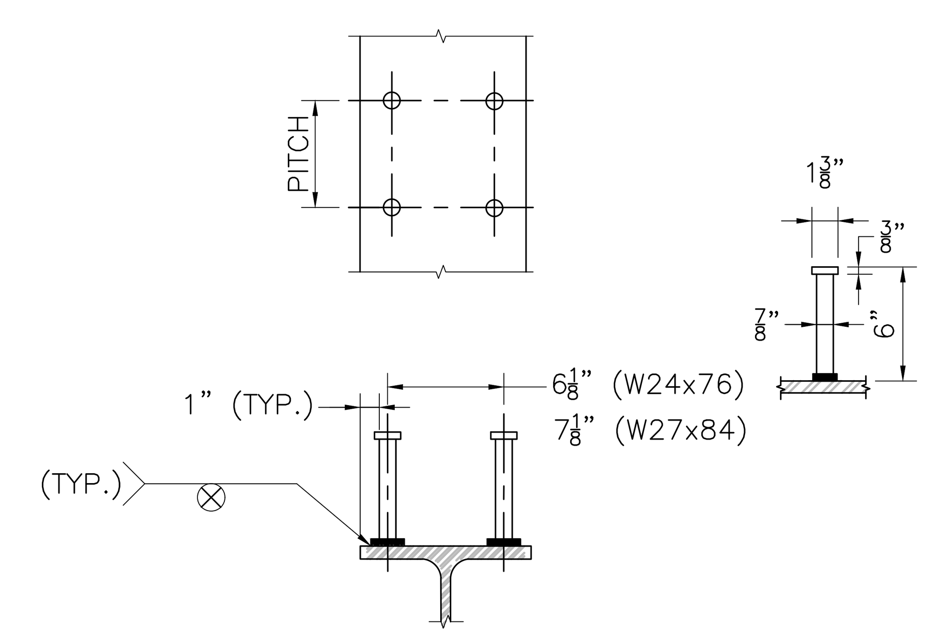
B1–B3, BB6 BEAM ELEVATION AT TYPICAL BAY

SCALE: $\frac{3}{8}$" = 1'-0"



B4–B5, B7–B12 BEAM ELEVATION AT UTILITY BAY

SCALE: $\frac{3}{8}$" = 1'-0"



SHEAR STUD CONNECTORS

NOT TO SCALE

FRAMING NOTES:

1. D1 = TYPICAL END DIAPHRAGM
   D2 = END DIAPHRAGM UNDER SIDEWALK
2. U1 = TYPICAL END UTILITY SUPPORT
   U2 = TYPICAL INTERMEDIATE UTILITY SUPPORT
3. SEE SHEET 15 FOR DIAPHRAGM AND UTILITY SUPPORT DETAILS.
4. THE MAIN LOAD CARRYING MEMBERS ARE STRINGERS B1–B12.
5. ALL STEEL SHALL CONFORM TO AASHTO M270 GRADE 50.

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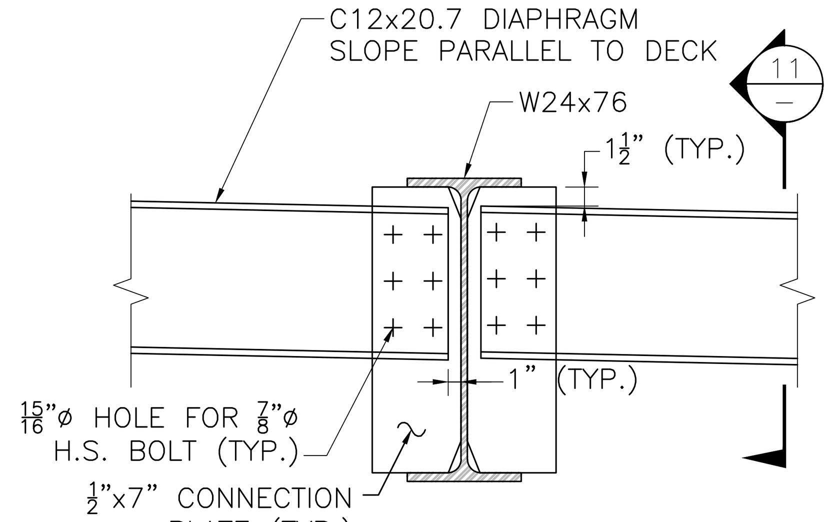
BRIDGE REPLACEMENT

TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

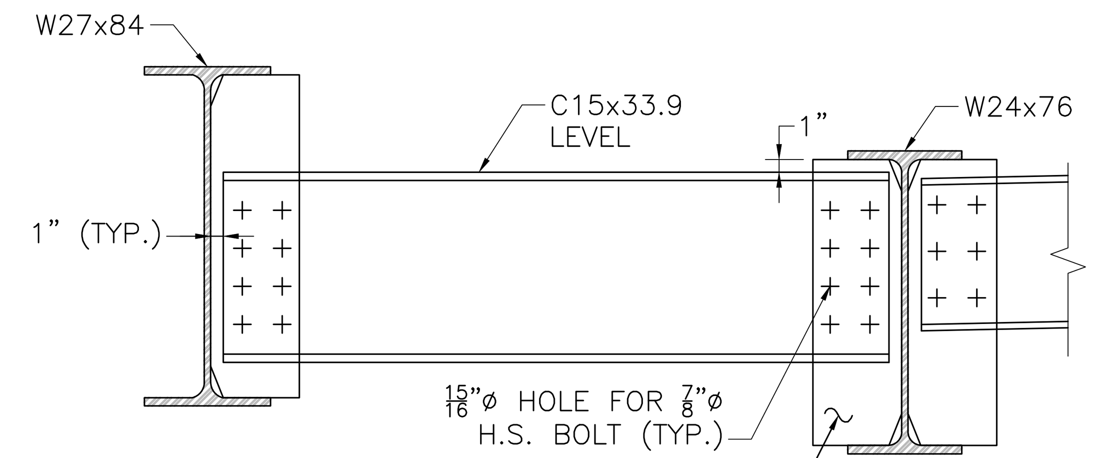
FRAMING PLAN

SHEET 14 OF 25



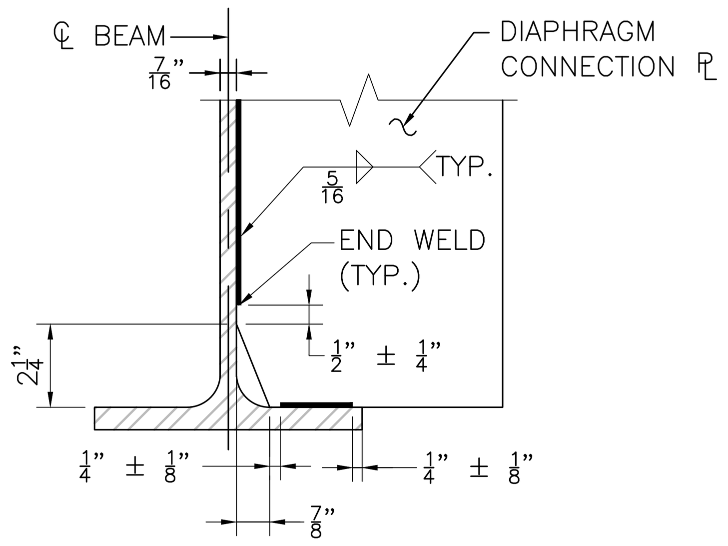
TYPICAL END DIAPHRAGM – D1

SCALE: 1" = 1'-0"



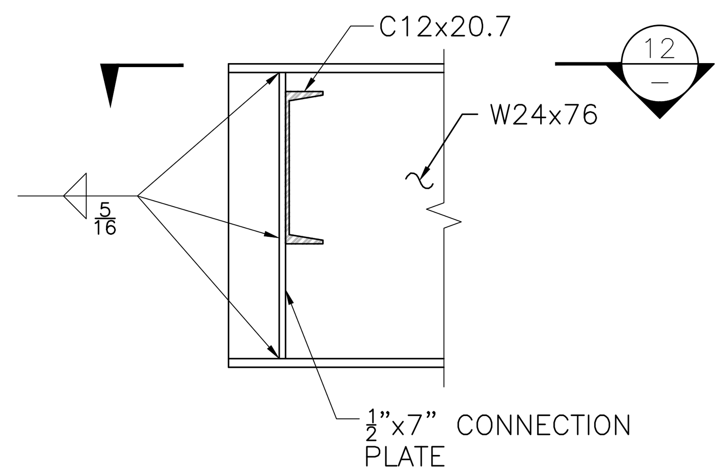
END DIAPHRAGM UNDER SIDEWALK– D2

SCALE: 1" = 1'-0"



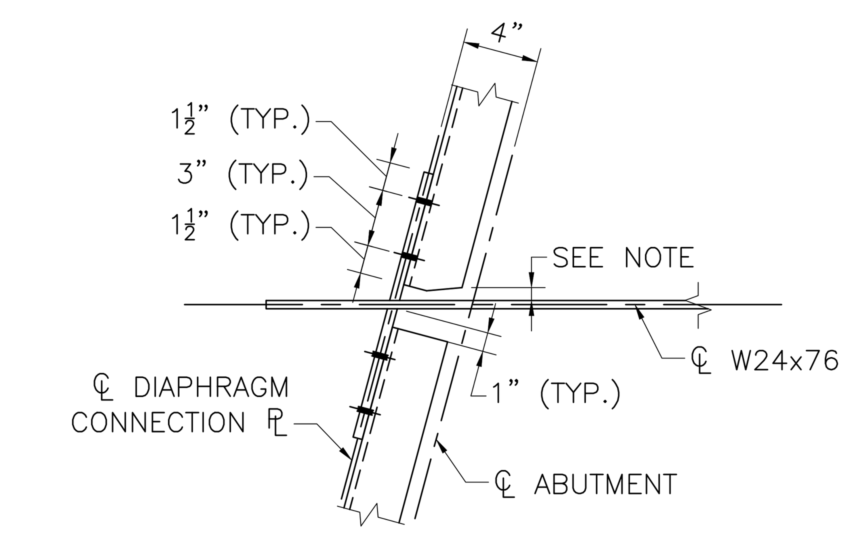
CLIP DETAIL

SCALE: 3" = 1'-0"



SECTION 11

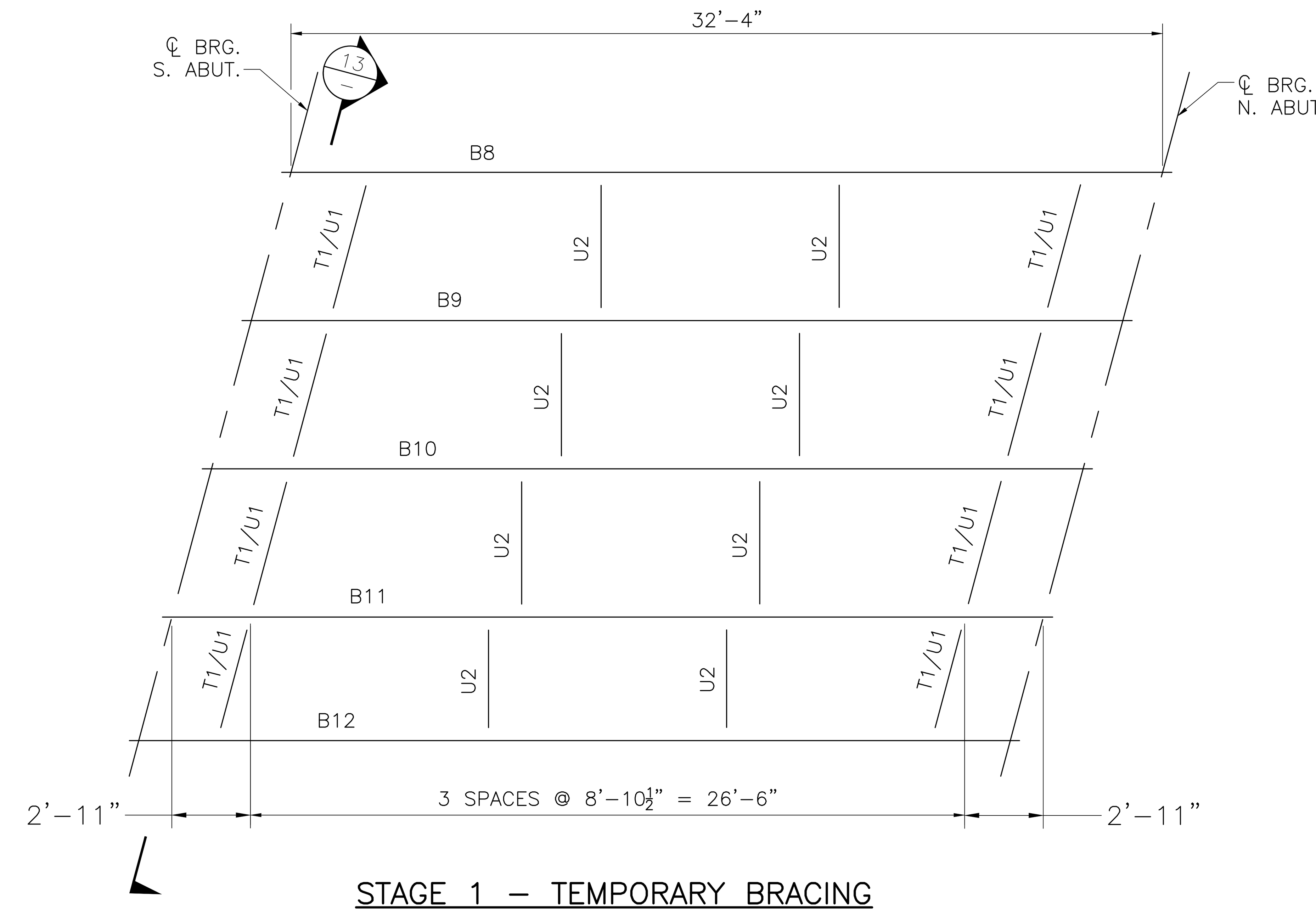
SCALE: 1½" = 1'-0"



NOTE:
FLANGE OF CHANNEL MAY BE CLIPPED TO AVOID INTERFERENCE WITH WEB.

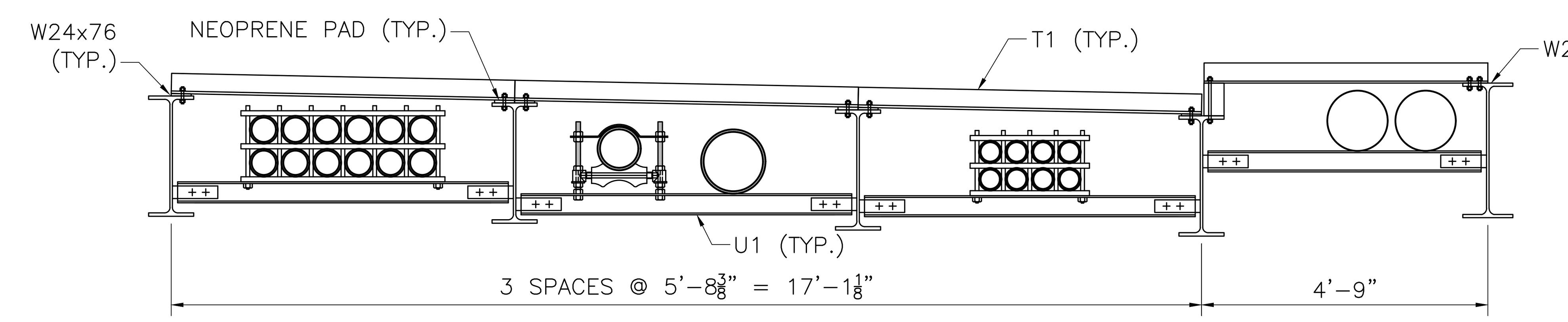
SECTION 12

SCALE: 1½" = 1'-0"



STAGE 1 – TEMPORARY BRACING

SCALE: ¼" = 1'-0"

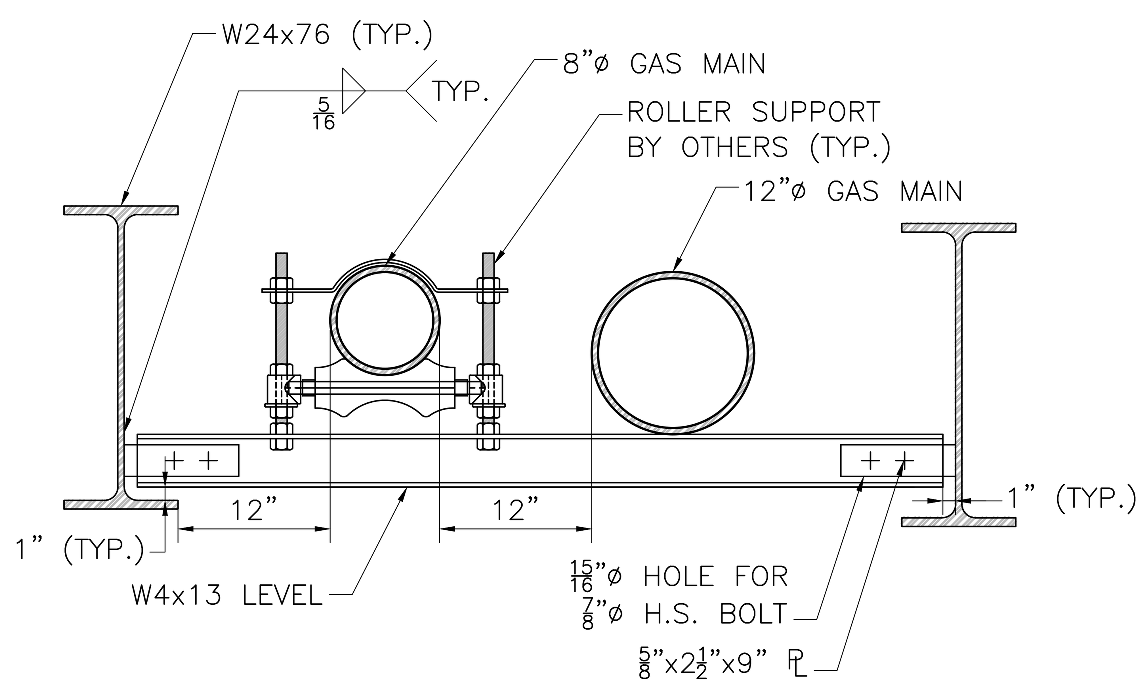


SECTION 13

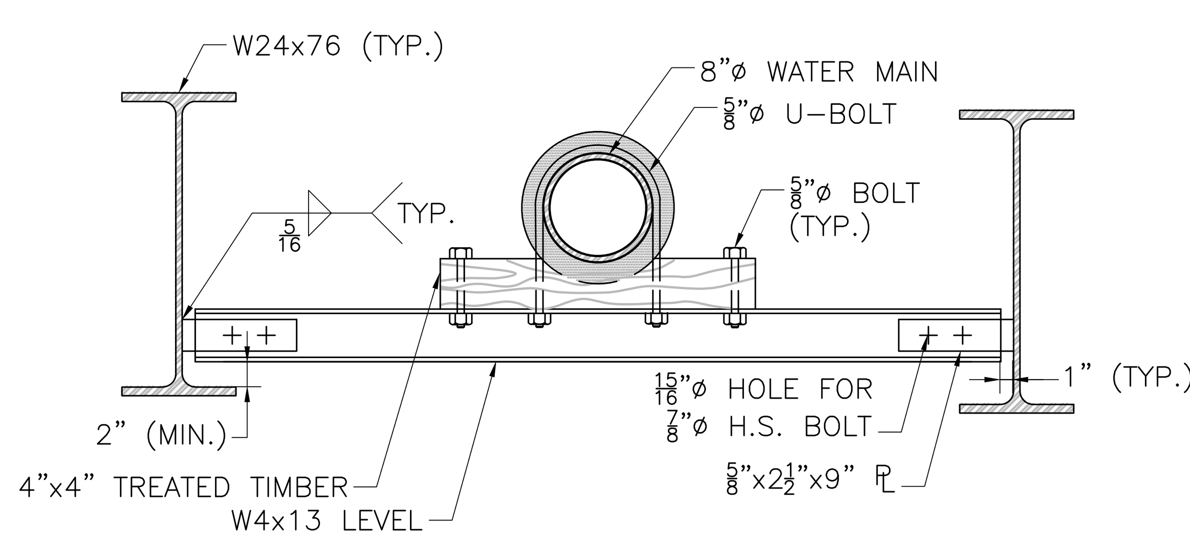
SCALE: ½" = 1'-0"

TEMPORARY BRACING NOTES:

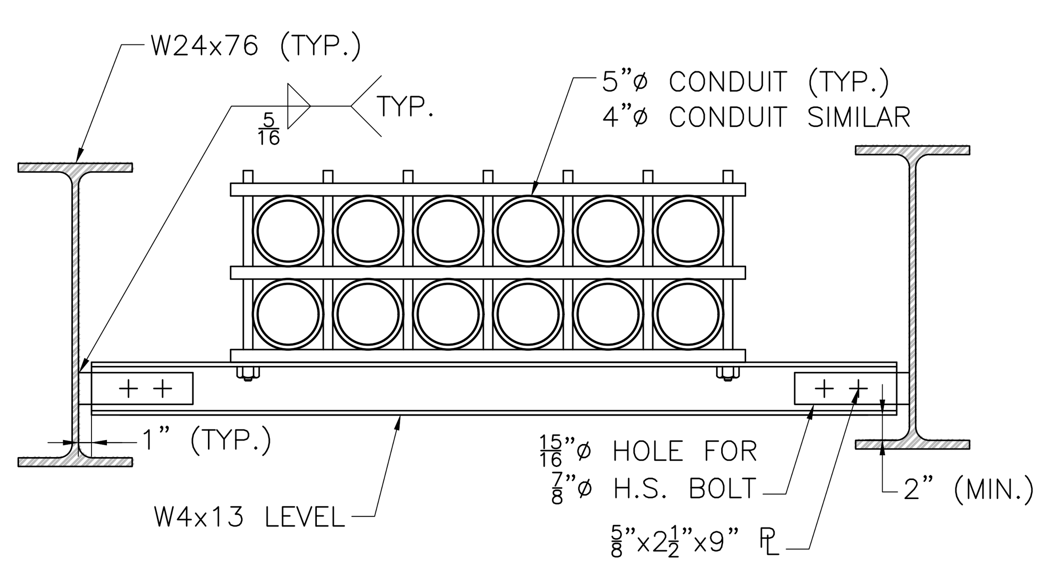
1. T1 = WT4x12 TEMPORARY BRACING MAY BE LEFT IN PLACE.
2. ALL STEEL SHALL CONFORM TO AASHTO M270 GRADE 50 AND SHALL NOT BE HOT DIP GALVANIZED.
3. TEMPORARY BRACING SHALL BE LEFT IN PLACE IF TRANSVERSE CONSTRUCTION JOINTS AT EACH ABUTMENT ARE OMITTED WITH THE APPROVAL OF THE ENGINEER. SEE SHEET 16.



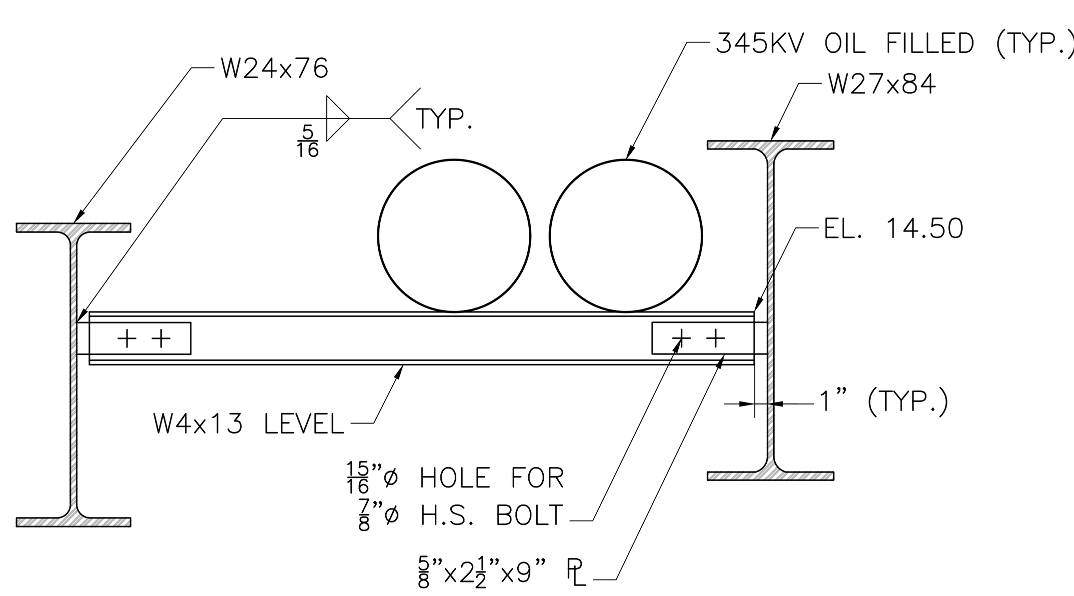
GAS LINE SUPPORT DETAILS



WATER LINE SUPPORT DETAILS



ELECTRICAL & TELECOM CONDUITS SUPPORT DETAILS



345KV ELECTRIC SUPPORT DETAILS

UTILITY SUPPORT – U1/U2

SCALE: 1" = 1'-0"

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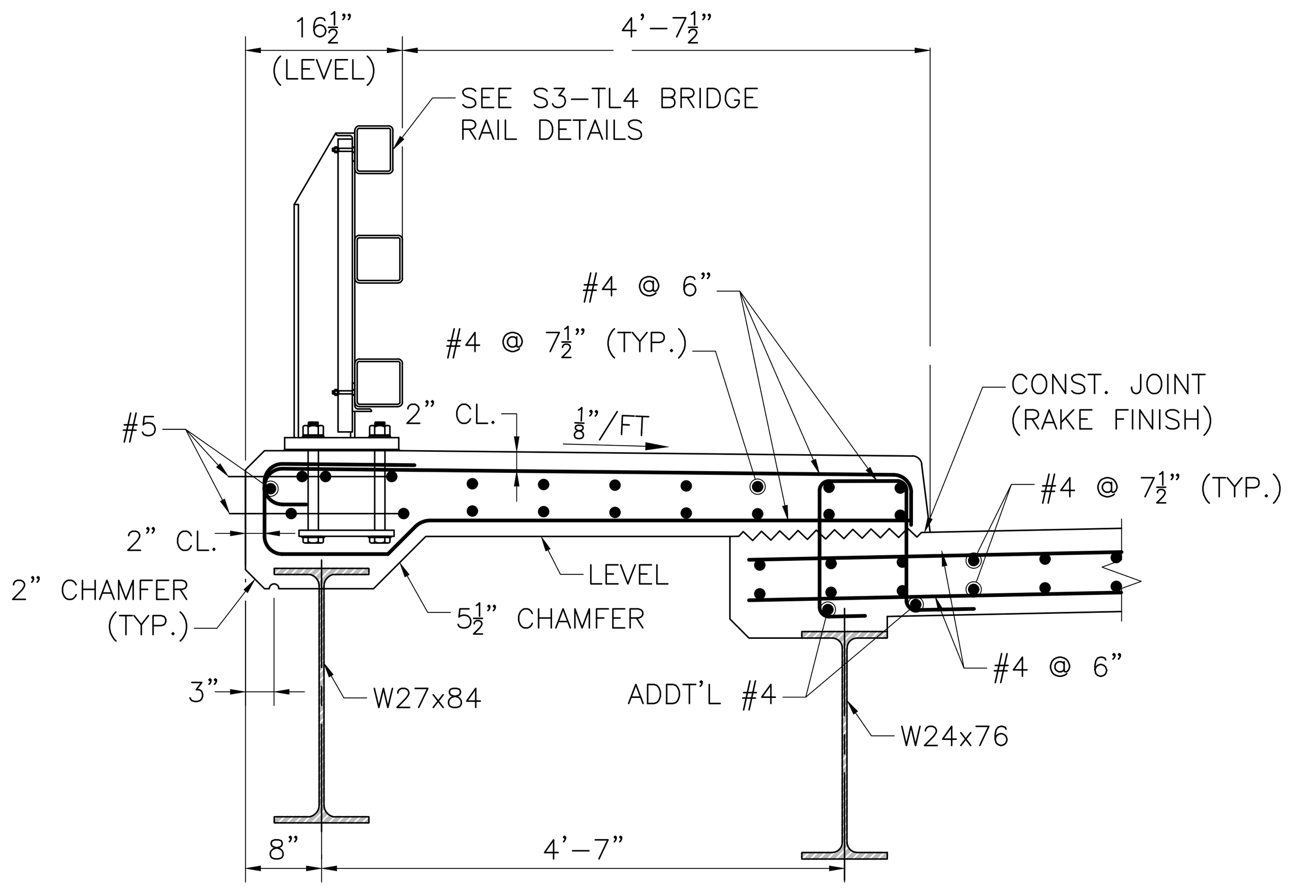
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

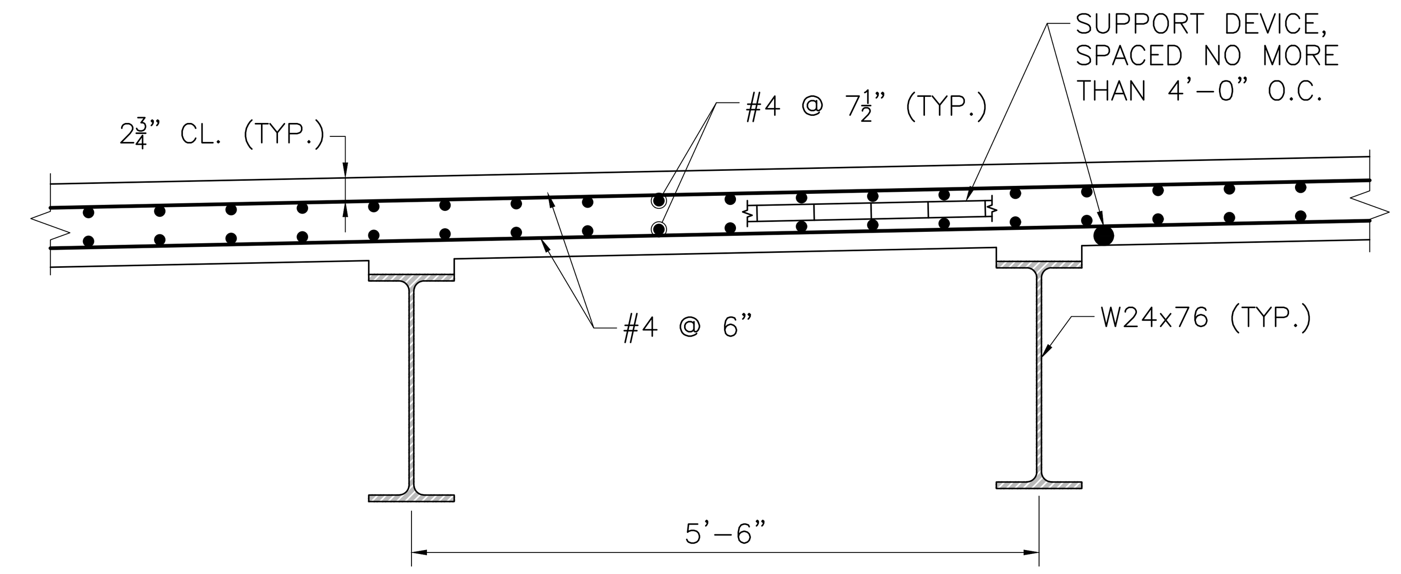
STEEL DETAILS

SHEET 15 OF 25



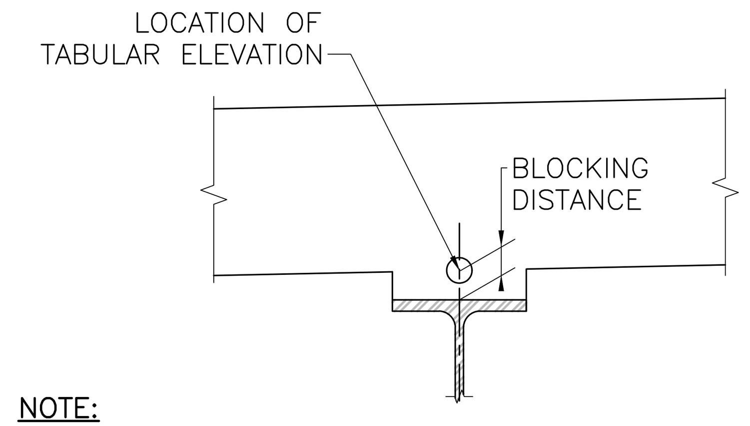
SIDEWALK REINFORCEMENT

SCALE: ¾" = 1'-0"



TYPICAL DECK REINFORCEMENT

SCALE: ¾" = 1'-0"

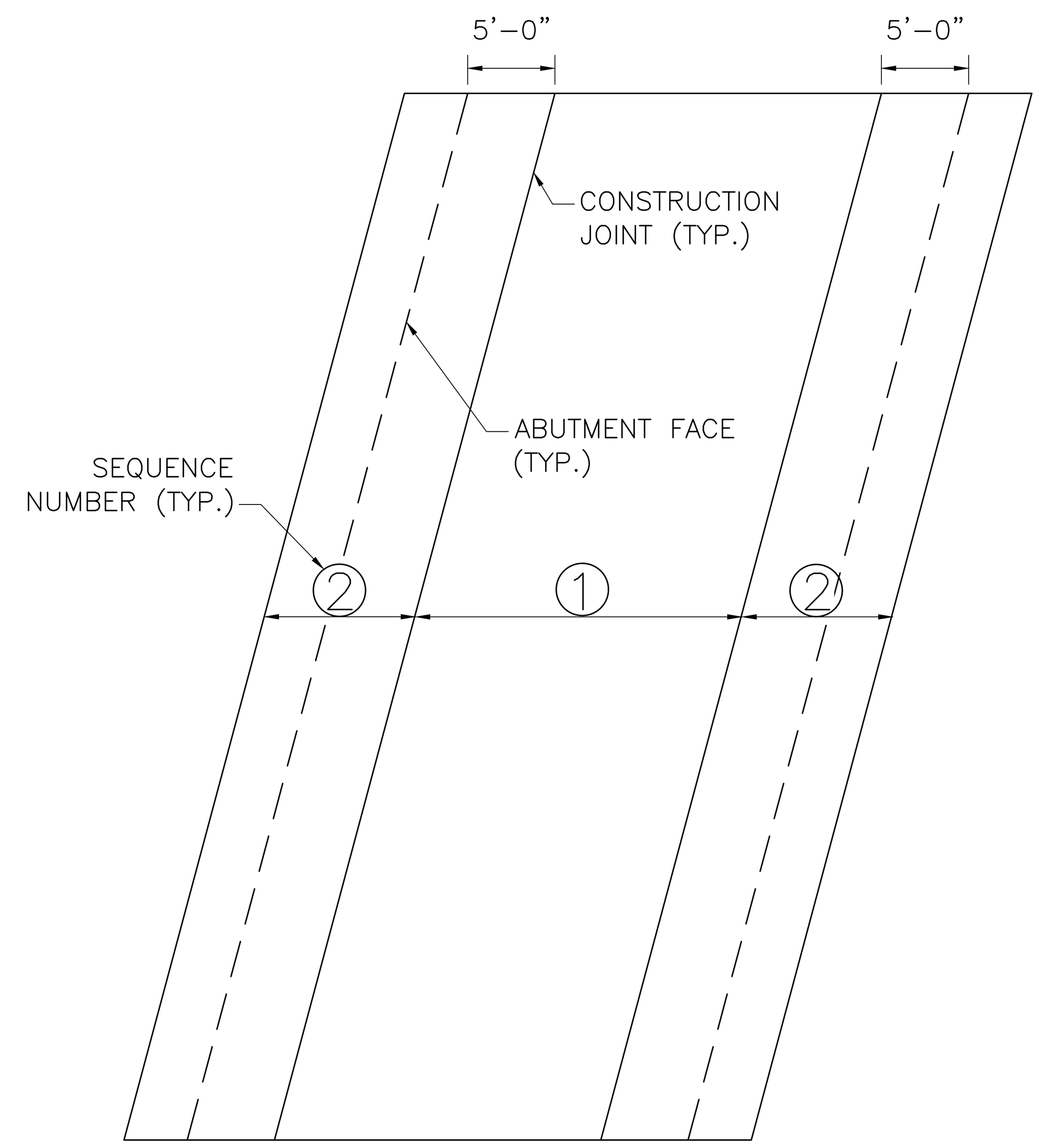


NOTE:

AFTER THE BEAMS ARE ERECTED BUT BEFORE THE FORMS ARE BUILT, ELEVATIONS ON TOP OF THE FLANGE OF THE BEAMS ARE TO BE OBTAINED AT THE POINTS INDICATED IN THE TABLE. THE DIFFERENCE BETWEEN TH ELEVATIONS OBTAINED AND THOSE SHOWN IN THE TABLE GIVES THE ACTUAL BLOCKING DISTANCE FROM THE TOP OF BEAM TO THE BOTTOM OF THE SLAB AT CENTER LINE OF BEAM.

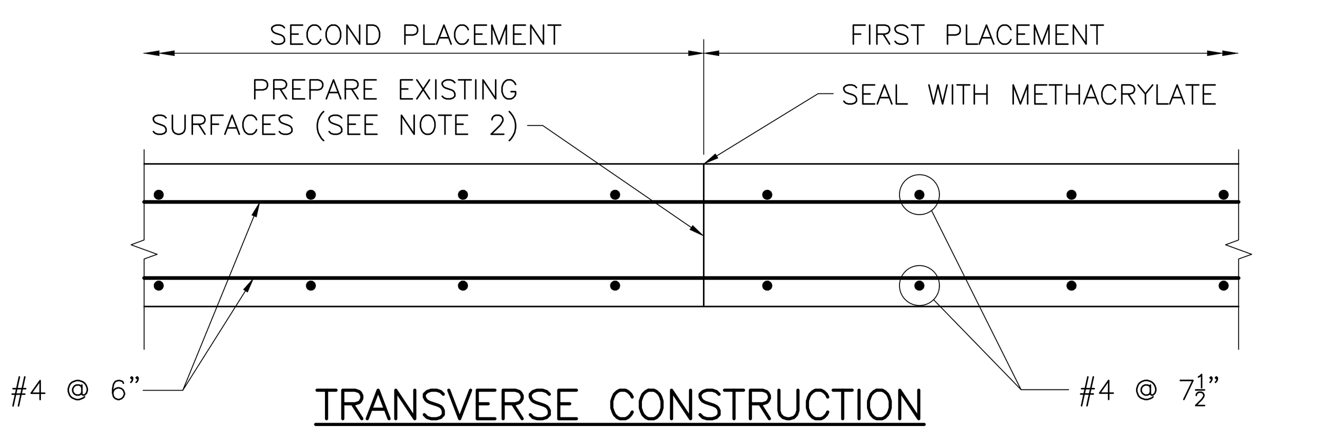
HAUNCH DETAIL
TOP OF FORM DETAILS

NOT TO SCALE



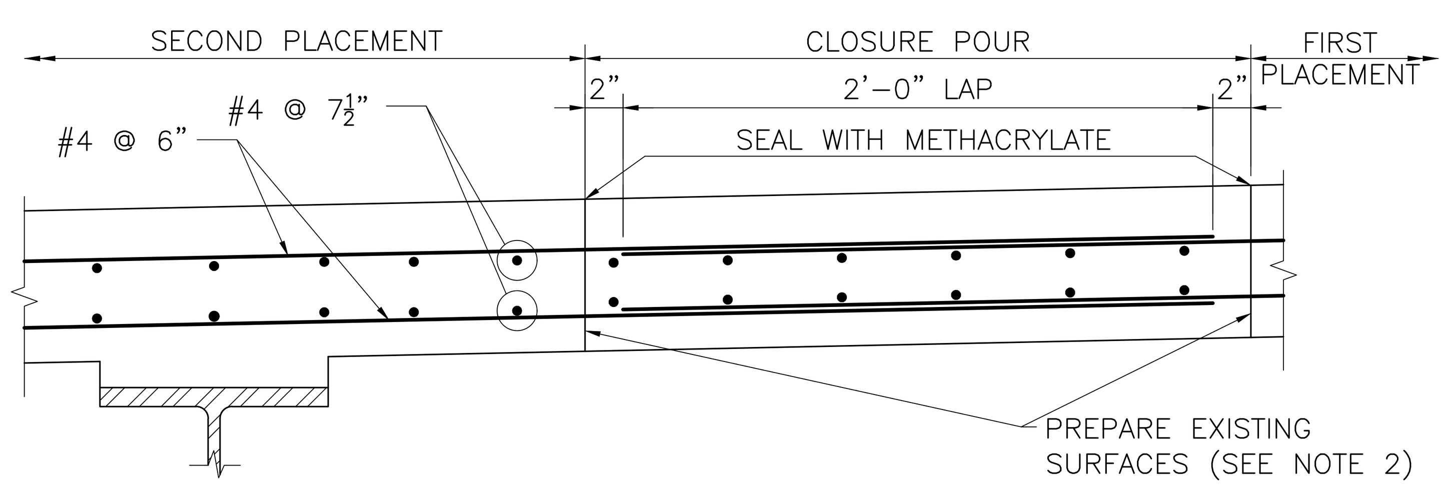
DECK PLACEMENT SEQUENCE

SCALE: 1" = 100'-0"



TRANSVERSE CONSTRUCTION JOINT DETAIL IN DECK SLAB

SCALE: 1½" = 1'-0"



LONGITUDINAL CONSTRUCTION JOINT DETAIL IN DECK SLAB

SCALE: 1½" = 1'-0"

TOP OF FORM ELEVATIONS FOR DECK SLAB PRIOR TO PLACEMENT OF CONCRETE

STRINGER NO.	INCREASING STATIONS				
	℄ BRG. S. ABUT.	¼ PT.	½ PT.	¾ PT.	℄ BRG. N. ABUT.
B1	15.73	15.69	15.65	15.60	15.55
B2	15.01	14.97	14.93	14.88	14.83
B3	15.13	15.10	15.06	15.01	14.95
B4	15.25	15.22	15.18	15.13	15.07
B5	15.37	15.34	15.31	15.25	15.20
B6	15.50	15.47	15.43	15.38	15.32
B7	15.50	15.47	15.44	15.39	15.33
B8	15.40	15.37	15.33	15.28	15.22
B9	15.29	15.26	15.22	15.17	15.11
B10	15.18	15.16	15.12	15.07	15.01
B11	15.08	15.04	15.00	14.96	14.90
B12	15.81	15.78	15.74	15.69	15.64

DECK REINFORCEMENT NOTES:

1. ROADWAY DECK SLAB SHALL BE 4000 PSI, ¾ IN, 585 HP CEMENT CONCRETE.
2. LONGITUDINAL REINFORCEMENT SHALL BE PLACED PARALLEL TO THE ℄ OF CONSTRUCTION. TRANSVERSE (PRIMARY) REINFORCEMENT SHALL BE PLACED PERPENDICULAR TO THE ℄ OF CONSTRUCTION.
3. ALL REINFORCEMENT AND SUPPORT DEVICES SHALL BE COATED.
4. BRIDGE DECK SHALL BE GROOVED TRANSVERSELY USING MULTI-BLADED SELF-PROPELLED SAWCUTTING EQUIPMENT.

CONSTRUCTION JOINT NOTES:

1. BRIDGE DECK SLAB SHALL BE PLACED IN ACCORDANCE WITH THE PLACEMENT SEQUENCE SHOWN ON THE PLANS.
2. THE SURFACE OF THE PREVIOUSLY CAST CONCRETE SHALL BE BLAST CLEANED, ROUGHENED, WETTED WITH CLEAN WATER, AND THEN FLUSHED WITH A MORTAR COMPOSED OF EQUAL PARTS OF THE CEMENT AND SAND SPECIFIED FOR THE NEW CONCRETE, BEFORE NEW CONCRETE IS PLACED ADJACENT THERETO. NEW CONCRETE SHALL BE PLACED BEFORE MORTAR HAS TAKEN INITIAL SET.
3. IN LIEU OF THE MORTAR, AN EPOXY ADHESIVE SUITABLE FOR BONDING FRESH CONCRETE TO HARDENED CONCRETE FOR LOAD BEARING APPLICATIONS MAY BE USED. THE EPOXY ADHESIVE SHALL CONFORM TO AASHTO M 235 TYPE V AND SHALL BE APPLIED IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
4. DOWEL BAR SPLICERS SHALL BE USED WHERE USE OF LAP SPLICES IS NOT FEASIBLE.
5. TRANSVERSE DECK CONSTRUCTION JOINTS MAY BE OMITTED PROVIDED THE MIX REMAINS FULLY PLASTIC DURING THE ENTIRE DECK AND ABUTMENT DIAPHRAGM PLACEMENT. TRIAL BATCH TESTING TO VALIDATE INITIAL SET TIME WILL BE REQUIRED.
6. LONGITUDINAL STAGE CONSTRUCTION JOINTS NOT SHOWN.
7. PERMANENT SIP DECK FORMS ARE NOT PERMITTED.

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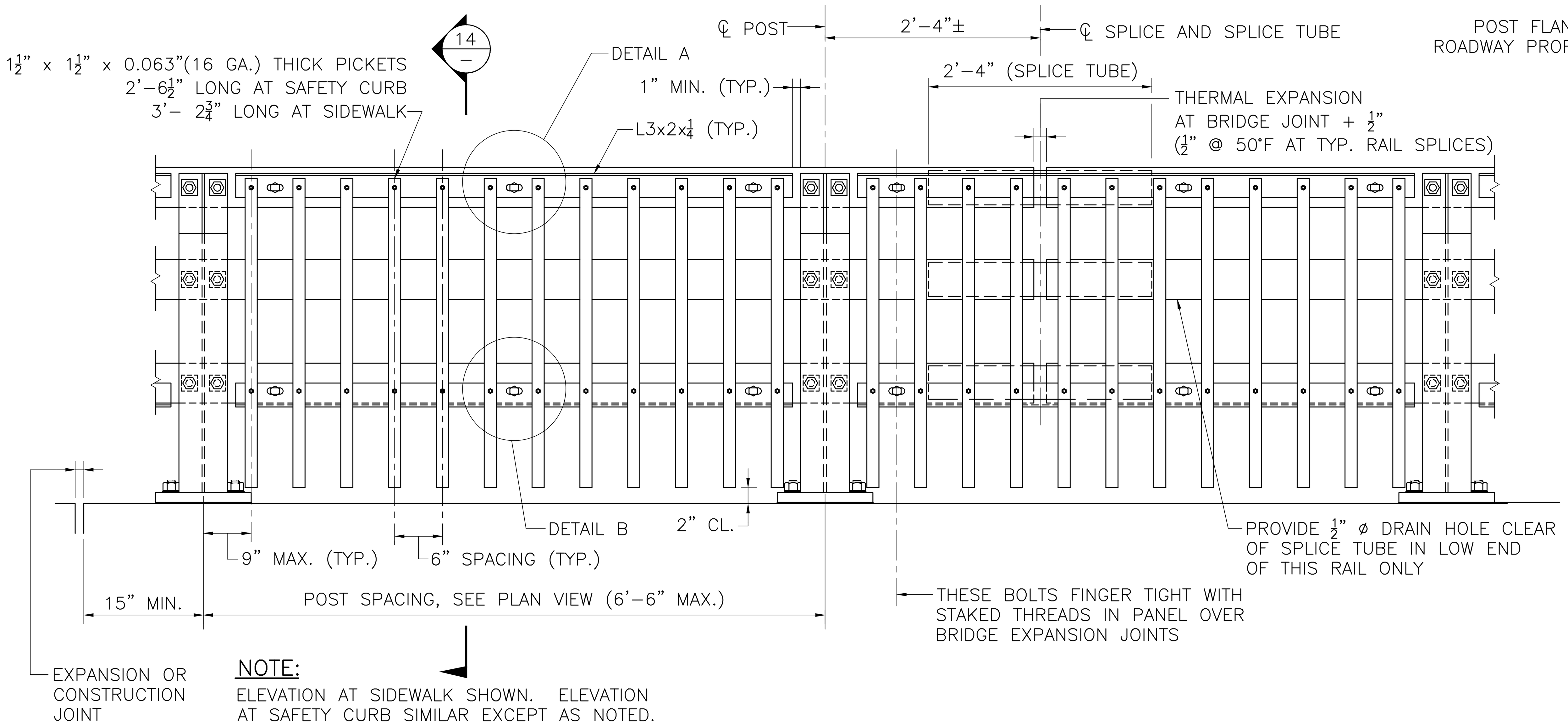
BRIDGE REPLACEMENT
TOWN OF ARLINGTON

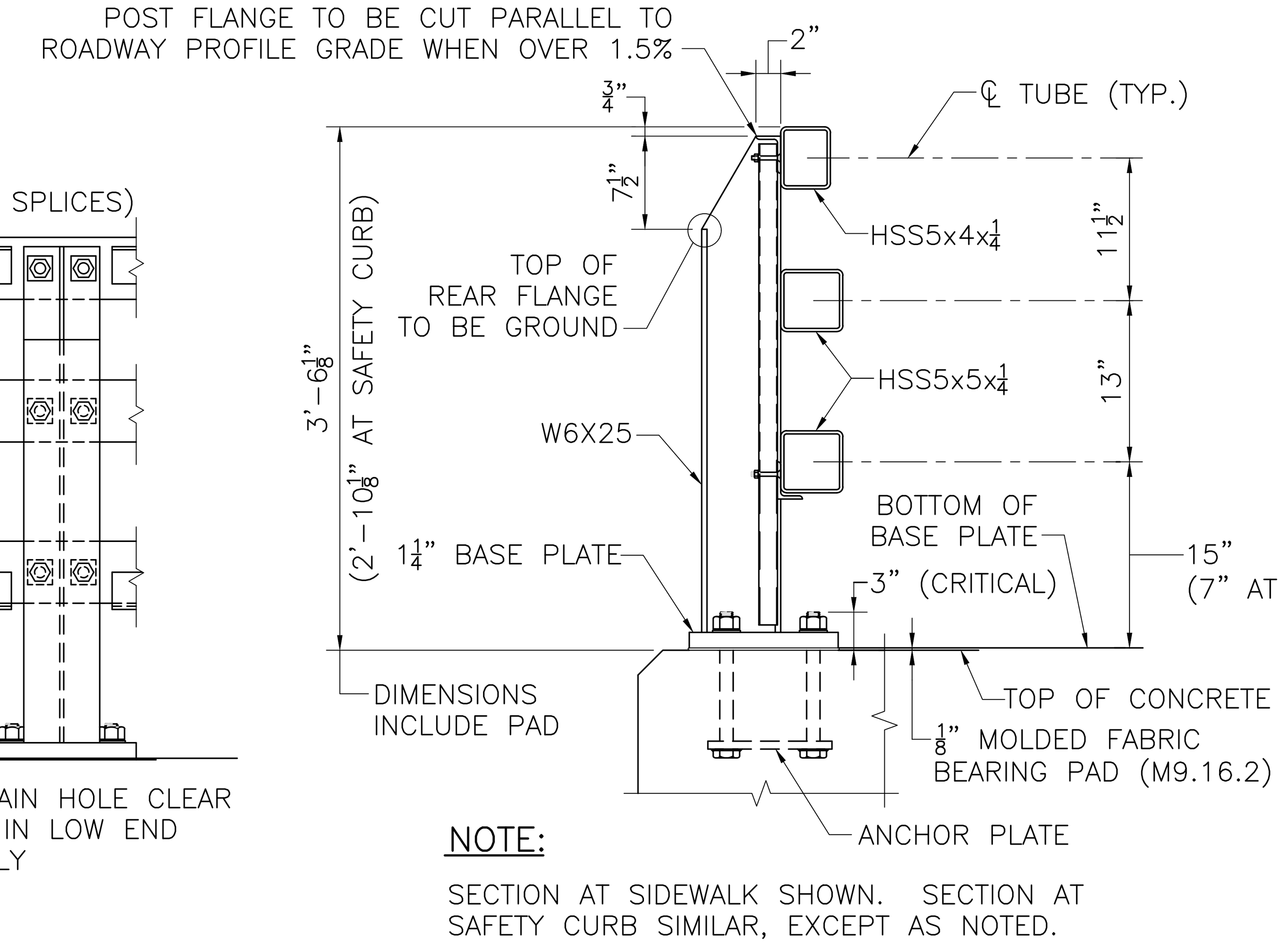
PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

DECK DETAILS

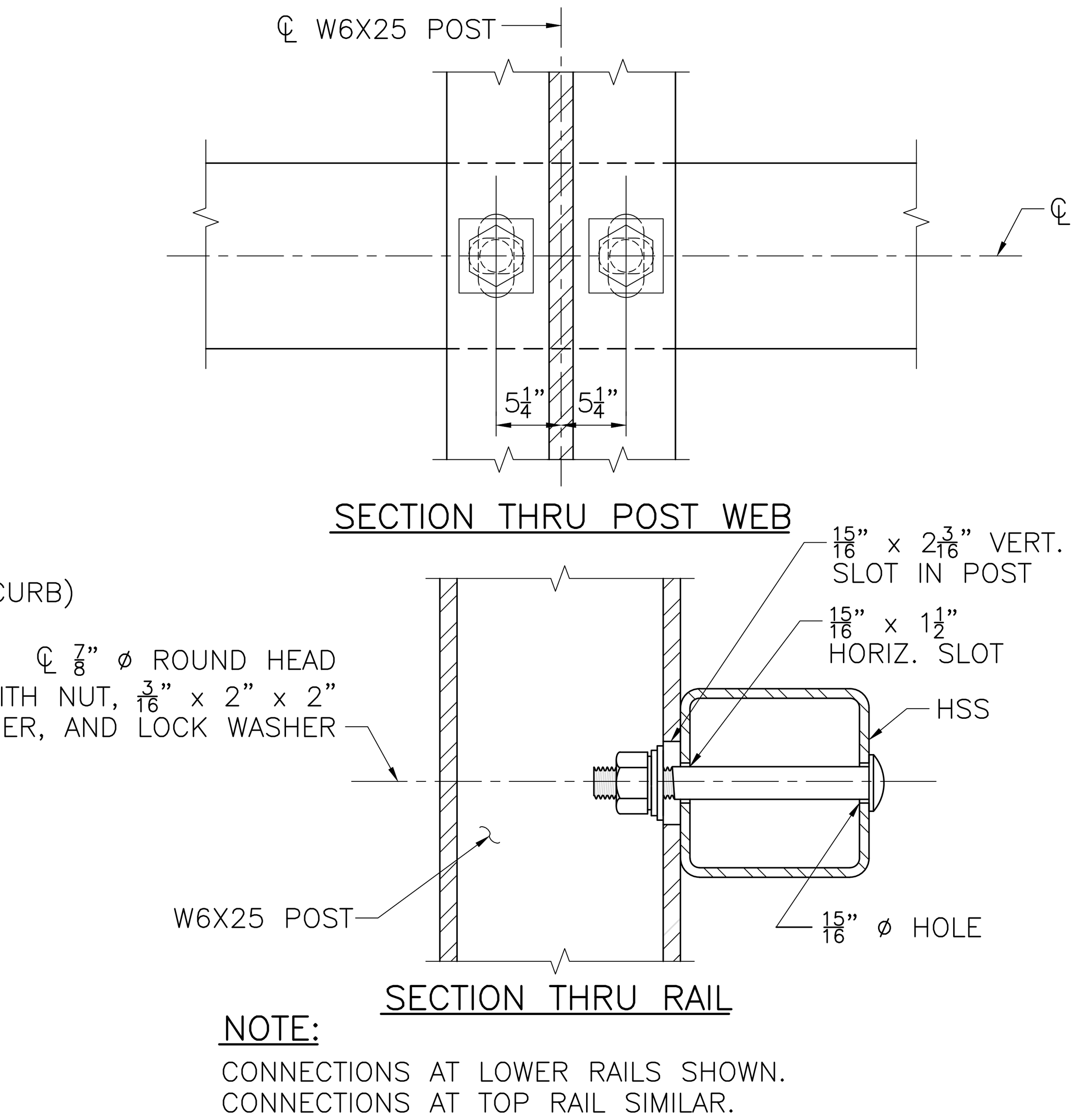
SHEET 16 OF 25



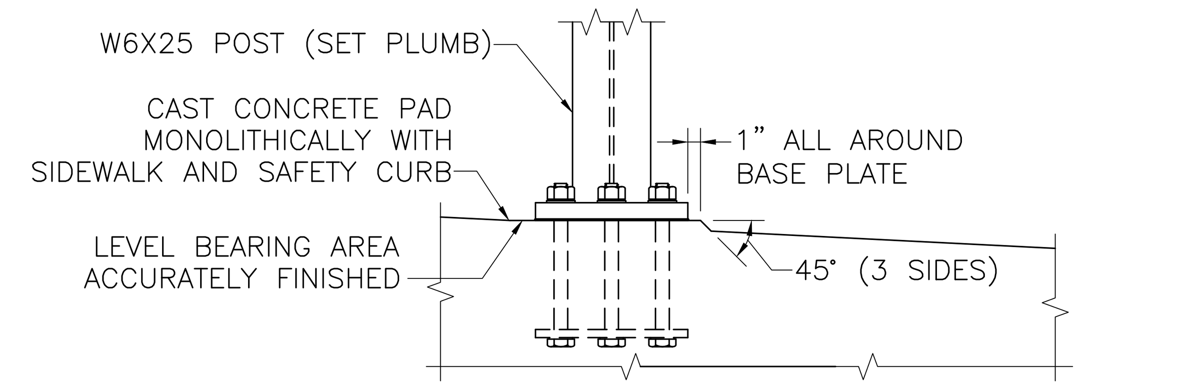
BRIDGE RAILING ELEVATION
SCALE: 1" = 1'-0"



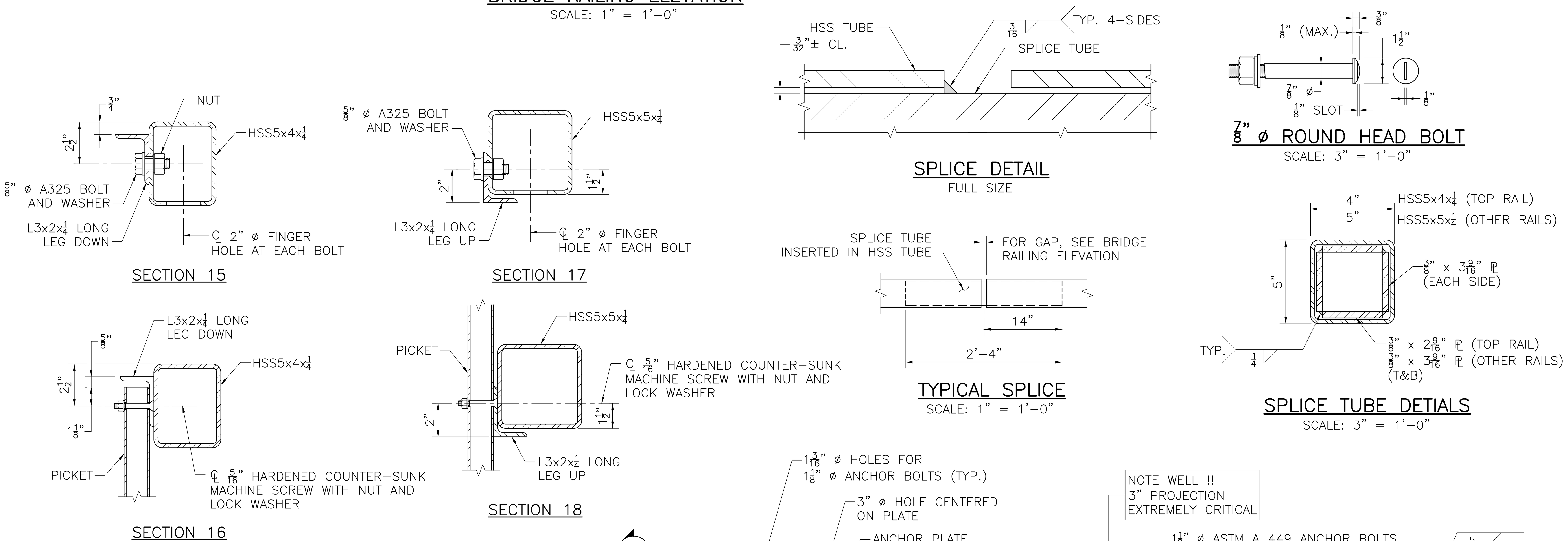
SECTION 14
SCALE: 1" = 1'-0"

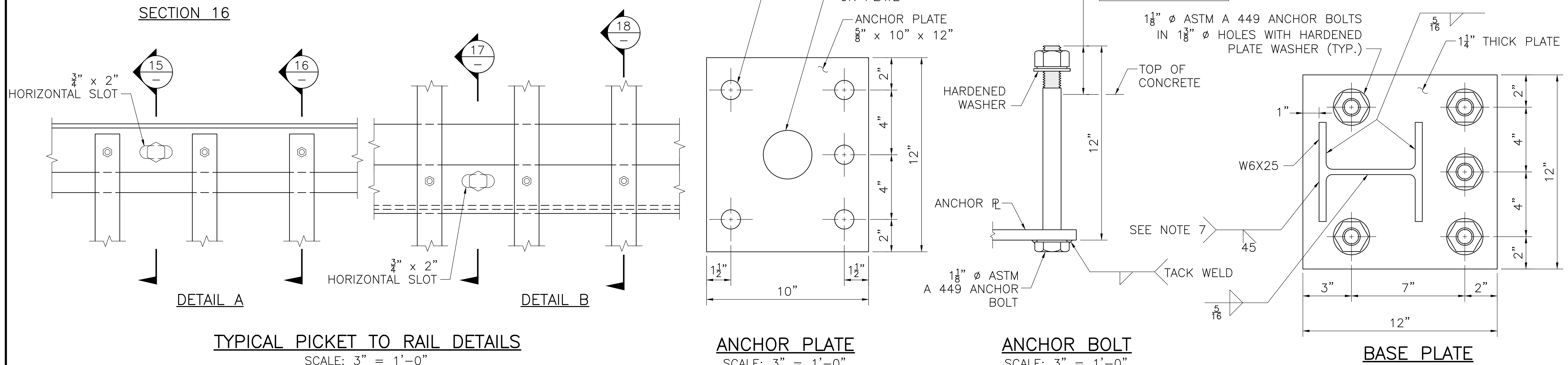


TYPICAL RAIL TO POST CONNECTIONS
SCALE: 1" = 1'-0"



SETTING OF POSTS (PROFILE GRADE OVER 1.5%)
SCALE: 1" = 1'-0"





RAILING NOTES:

1. RAIL POST AND BASE PLATES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M 270 GRADE 50. HOLLOW RAILING STRUCTURAL TUBING (HSS) SHALL CONFORM TO THE REQUIREMENTS OF ASTM A 500 WITH A CERTIFIED Fy = 50 KSI MINIMUM. THE MINIMUM HORIZONTAL BENDING RADII OF THE HSS TUBING SHALL BE 8 FEET. PICKET CARRIER ANGLES, ANCHOR PLATES, AND SPLICE TUBE PLATES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M 270 GRADE 36. PICKET TUBING SHALL CONFORM TO ASTM A 513 WITH Fy = 36 KSI MIN. OR A 500 GRADE B.
2. ALL STEEL (EXCEPT THE $\frac{5}{8}$" ANCHOR PLATE AND FASTENERS) SHALL BE GALVANIZED AND PAINTED DARK BRONZE (FEDERAL STD. 595B COLOR NO. 10045). ANCHOR PLATE SHALL BE GALVANIZED ONLY. HEADS OF $\frac{7}{8}$" ø ROUND HEAD BOLTS SHALL BE PAINTED TO MATCH RAIL.
3. ANCHOR BOLTS SHALL BE SET WITH TEMPLATES. THE NUT SECURING THE POST BASE PLATE TO THE CONCRETE SHALL BE TIGHTENED TO A SNUG FIT AND GIVEN AN ADDITIONAL 1/8 TURN AFTER STEEL IS IN PLACE.
4. RAILS SHALL BE CONTINUOUS OVER A MINIMUM OF FOUR (4) POSTS WITHOUT SPLICES WHERE POSSIBLE. RAILS SHALL BE SPLICED IN THE PANELS OVER EXPANSION JOINT.
5. ENDS OF TUBE SECTIONS SHALL BE SAWED. GRIND SMOOTH EXPOSED EDGES. ALL CUT ENDS SHALL BE TRUE AND SMOOTH.
6. ALL POSTS TO BE PLUMB WHEN PROFILE GRADE EXCEEDS 1.5%. FOR PROFILE GRADES LESS THAN 1.5%, POSTS SHALL BE SET PERPENDICULAR TO GRADE.
7. POST FLANGE WELD DOES NOT REQUIRE MAGNETIC PARTICLE TESTING. WELD SHALL BE BACK-GOUGED ON BACK SIDE EXCEPT AT WEB. WELD IS THE SAME ON BOTH FLANGES.
8. $\frac{7}{8}$" ø ROUND HEAD BOLTS SHALL CONFORM TO THE CHEMICAL AND PHYSICAL REQUIREMENTS OF AASHTO M 164.

S3-TL4 BRIDGE RAILING

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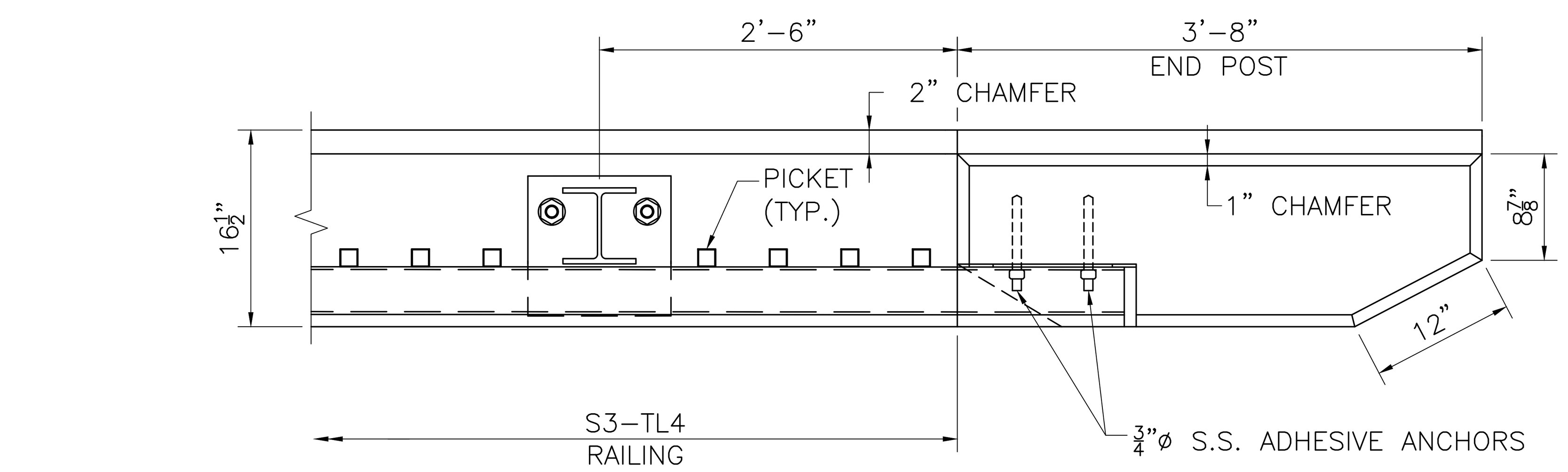
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

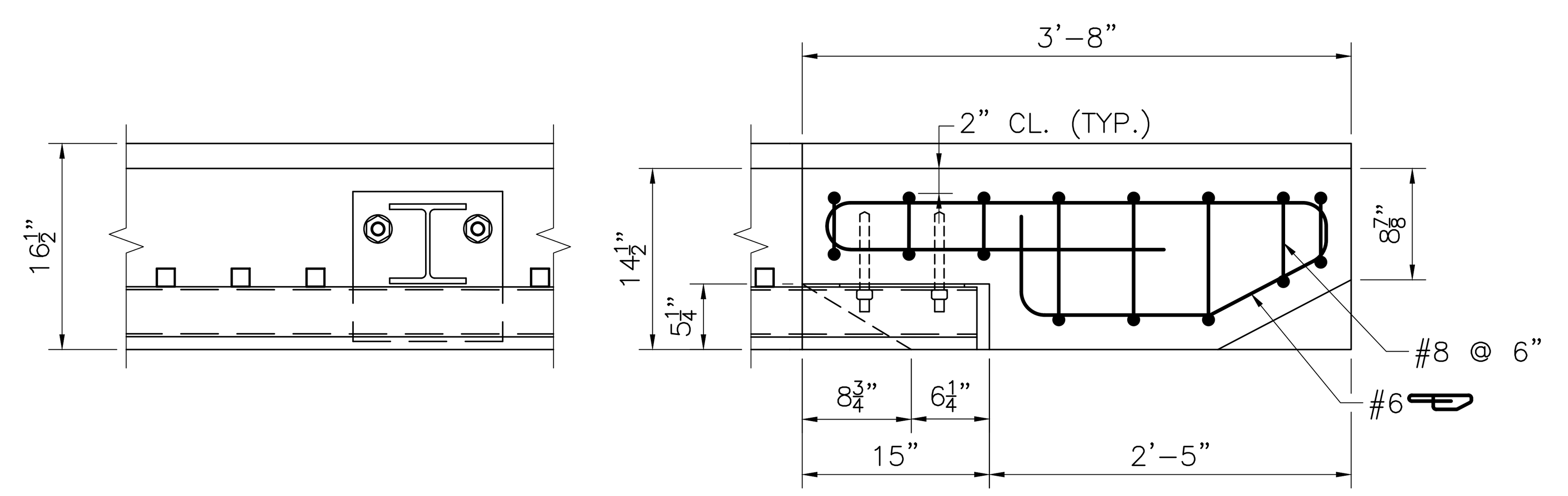
S3-TL4
BRIDGE
RAILING

SHEET 17 OF 25



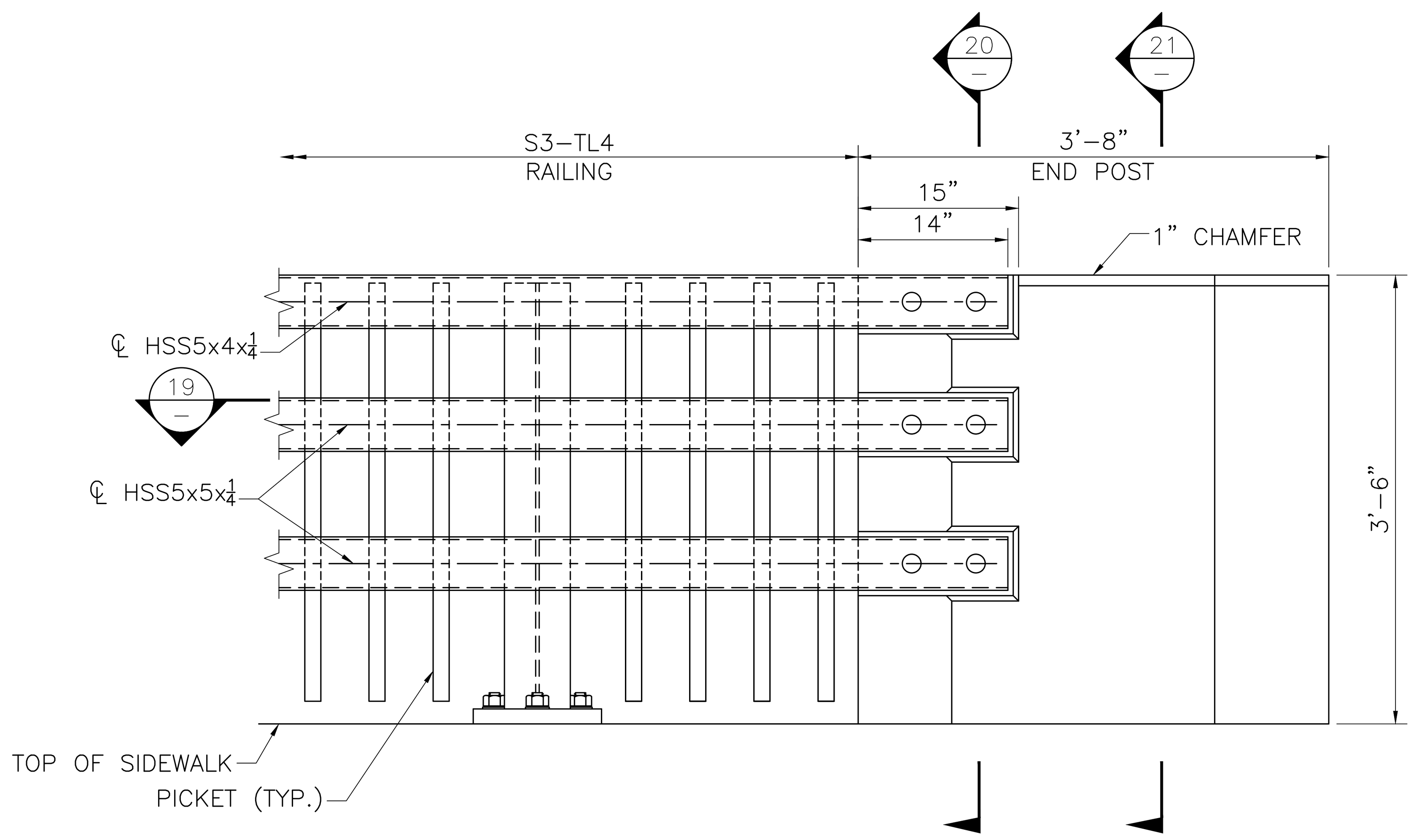
END POST – PLAN VIEW

SCALE: 1" = 1'-0"



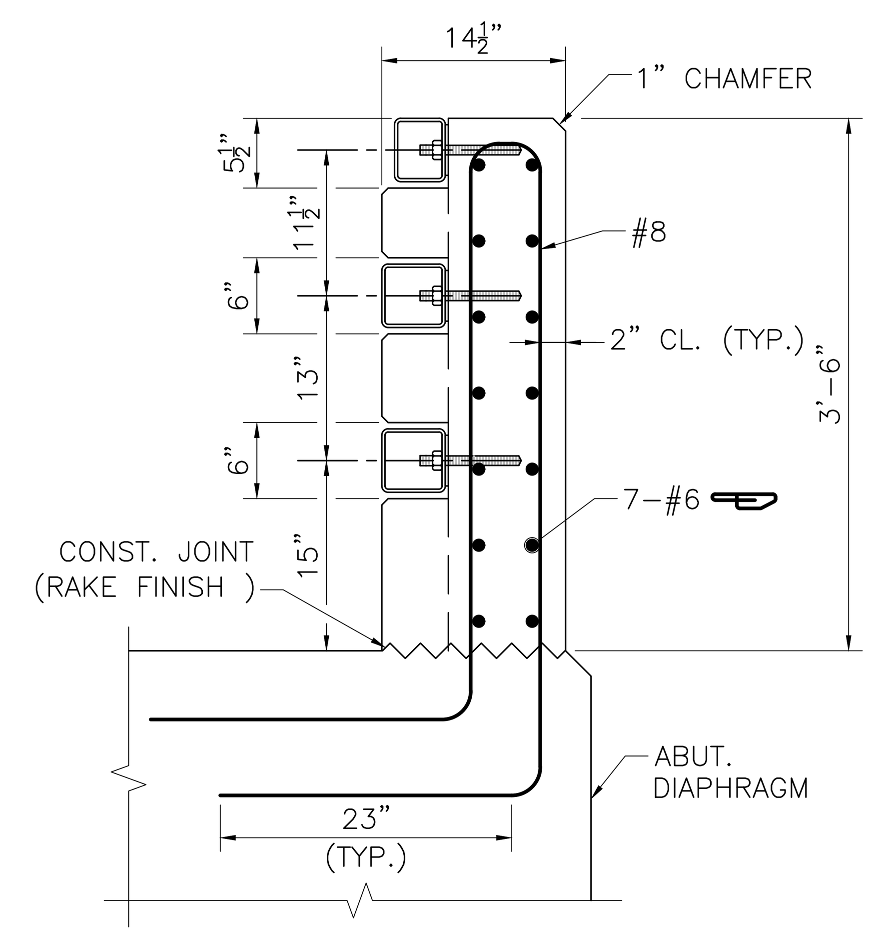
SECTION 19

SCALE: 1" = 1'-0"



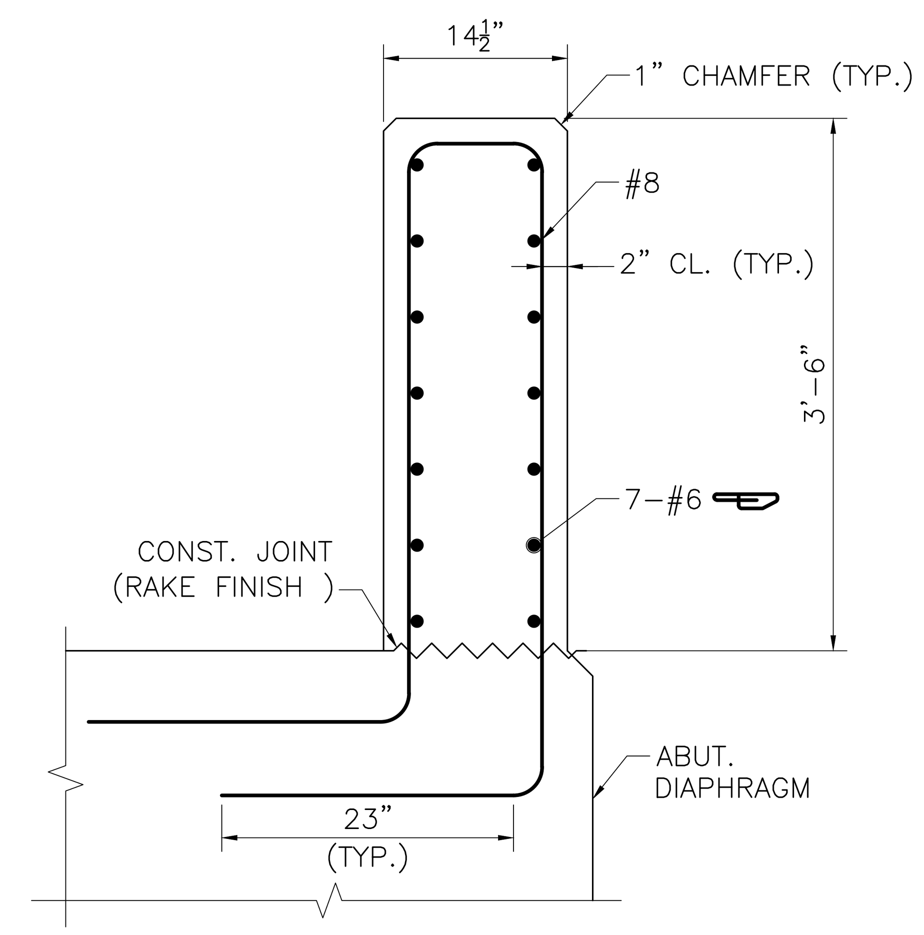
END POST – ELEVATION

SCALE: 1" = 1'-0"



SECTION 20

SCALE: 1" = 1'-0"



SECTION 21

SCALE: 1" = 1'-0"

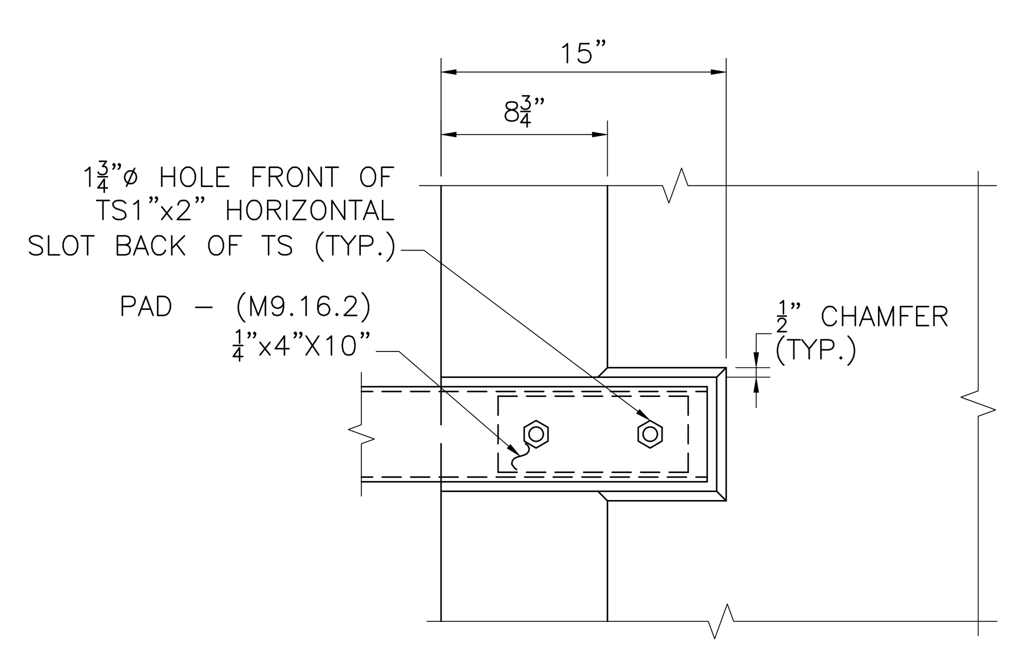
END POST NOTES:

1. FOR AN APPROACH GRADE UP TO 3%, THE TRANSITION MAY BE CAST SQUARE AND SET PLUMB WITH THE MINIMUM EMBEDMENT DEPTH SHOWN. THE TERMINAL CONNECTOR INSERT GROUP SHALL BE SQUARE TO THE POST.

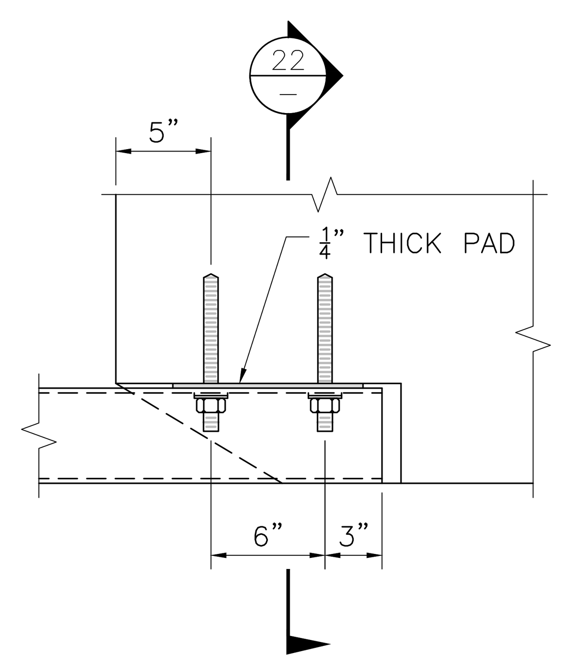
   FOR AN APPROACH GRADE IN EXCESS OF 3%, THE TRANSITION TOP AND THE TOP OF CURB SHALL FOLLOW THE APPROACH GRADE. THE HEIGHT OF THE TRANSITION TOP SHALL VARY PROVIDED THAT THE MINIMUM DIMENSIONS SHOWN ON THE CONSTRUCTION DRAWINGS ARE MET. THE BOTTOM OF THE TRANSITION BASE SHALL BE SET LEVEL WITH THE MINIMUM EMBEDMENT DEPTH SHOWN. THE TERMINAL CONNECTOR INSERT GROUP SHALL BE SLOPED TO FOLLOW THE APPROACH GRADE.

2. USE LATEST CONTRACT COMPLETION YEAR IN EFFECT WHEN THE FIRST GUARDRAIL TRANSITION IS CAST. USE THIS YEAR FOR ALL GUARDRAIL TRANSITIONS.

3. ALL CONCRETE FOR THE END POTS SHALL BE 5000 PSI, ¾", 685 HP CEMENT CONCRETE.



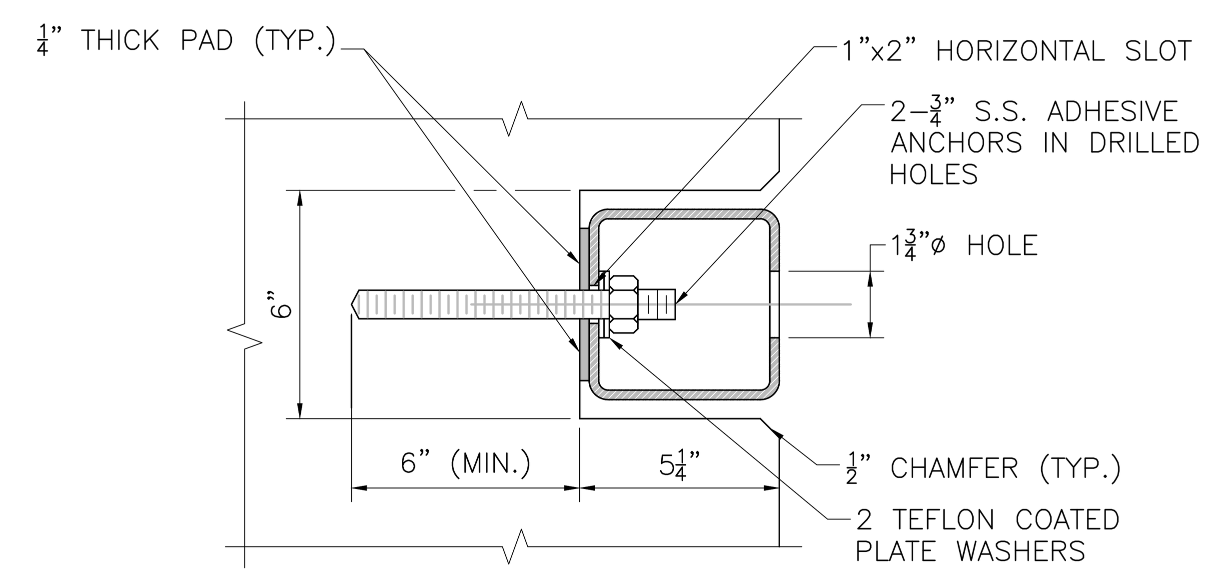
ELEVATION



PLAN

RAIL ATTACHMENT

SCALE: 1½" = 1'-0"



SECTION 22

SCALE: 1" = 1'-0"

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GILL ENGINEERING

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04/01/2021	FB	FB	AMS	CHAPTER 85 SUBMISSION

REGISTERED PROFESSIONAL ENGINEER

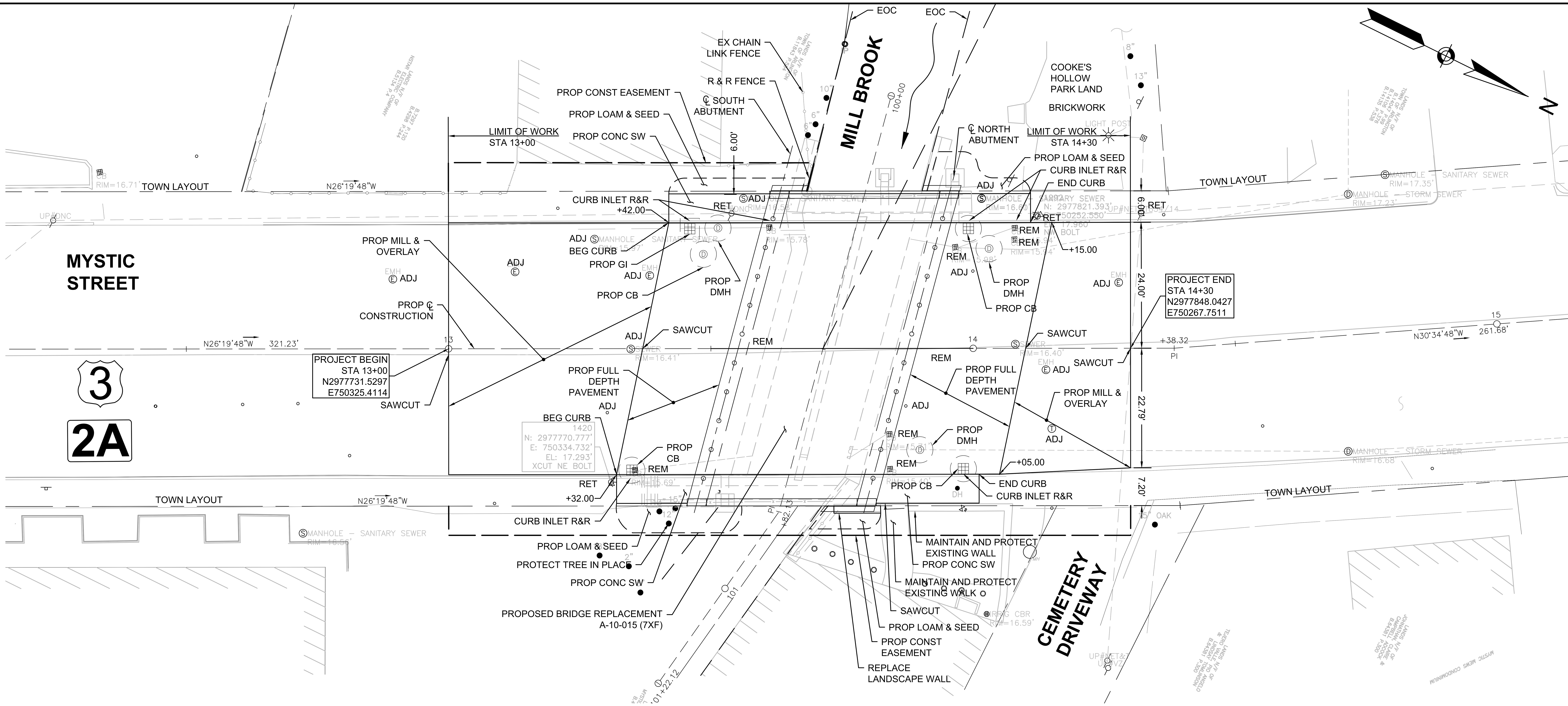
DATE

BRIDGE REPLACEMENT
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

END POST DETAILS

SHEET 18 OF 25



GENERAL PLAN
SCALE: 1" = 10'

NOTE: ABANDONED RAIL/TROLLEY TRACKS ARE EXPECTED TO BE PRESENT WITHIN THE PROJECT LIMITS BELOW THE SURFACE. ALL COSTS ASSOCIATED WITH REMOVAL, DISPOSAL, OR WORKING AROUND SHALL BE INCLUSIVE TO THE PAY ITEMS IN THE CONTRACT. THERE WILL BE NO SEPARATE PAYMENT DUE TO EXISTING RAIL/TROLLEY TRACKS.

PAVEMENT NOTES:

PROPOSED FULL DEPTH PAVEMENT
SURFACE COURSE: 1.5" - SUPERPAVE SURFACE COURSE - 9.5 (SSC - 9.5)
INTERMEDIATE COURSE: 2.5" - SUPERPAVE INTERMEDIATE COURSE - 19.0 (SIC - 19.0)
BASE COURSE: 4.5" - SUPERPAVE BASE COURSE - 37.5 (SBC - 37.5)

SUB BASE COURSE: 4" - DENSE GRADED CRUSHED STONE FOR SUB-BASE
8" - GRAVEL BORROW, TYPE B

TACKCOAT: 0.07 GAL PER SY

PROPOSED MILL & OVERLAY:
MILLING: PAVEMENT STANDARD MILLING, 1.5"
(VARIABLE DEPTH FOR RE-PROFILING BRIDGE APPROACH)

SURFACE COURSE: 1.5" - SUPERPAVE SURFACE COURSE - 9.5 (SCC - 9.5)
TACKCOAT: 0.08 GAL PER SY

PROPOSED CONCRETE WALK
SURFACE: 4" CEMENT CONCRETE SIDEWALK

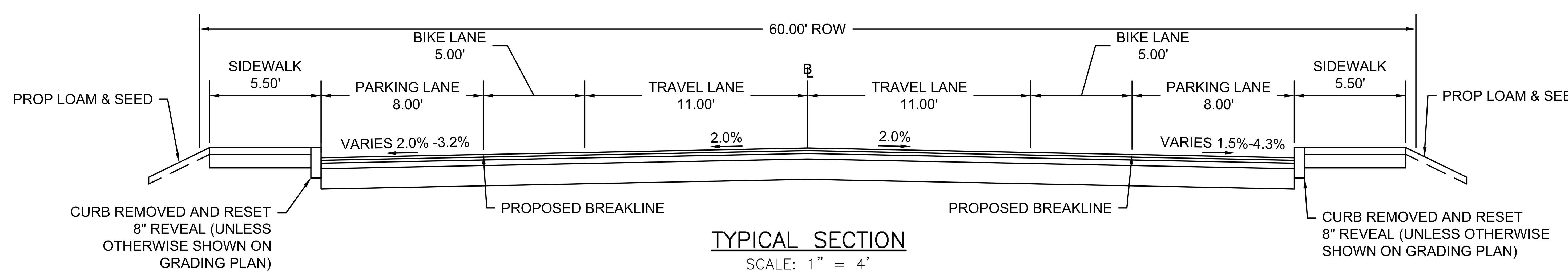
FOUNDATION: 8" GRAVEL BORROW - TYPE B

PAVEMENT MARKINGS:

ALL PAVEMENT MARKINGS SHALL BE REPLACED TO MATCH EXISTING CONDITIONS. SEE "MYSTIC STREET STRIPING PLAN", DATED NOV. 2016 FOR PAVEMENT MARKING LAYOUT, LEGENDS/SYMBOLS AND LIMITS.

UTILITY NOTES:

SEE UTILITY PLAN FOR ALL OTHER UTILITIES INCLUDING SANITARY SEWER.



TYPICAL SECTION
SCALE: 1" = 4'

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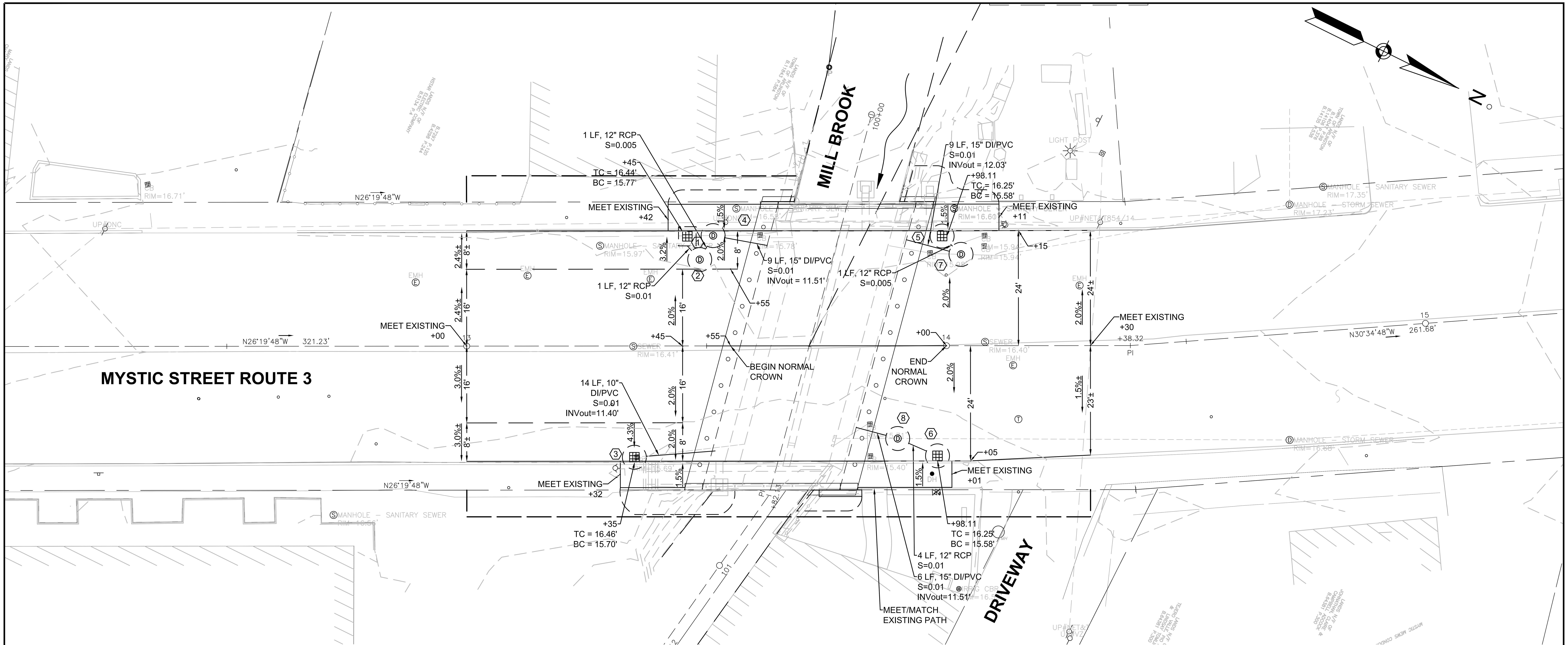
ROADWAY PLAN & TYPICAL SECTION
SHEET 19 OF 25



CURB TIE, GRADING, & DRAINAGE PLAN

SCALE: 1" = 10'

DRAINAGE STRUCTURE DATA						
NO.	TYPE	STATION/OFFSET	RIM ELEVATION	INVERT ELEV. IN	INVERT ELEV. OUT	REMARKS
1	GICI	+45, LT	15.77'	-	13.27'	
2	CBCI	+45, 18' LT	16.03'	(1) 13.26'	12.53'	FRAME AND COVER
3	CBCI	+35, RT	15.70'	-	11.54'	
4	DMH	+55, 23' LT	15.83'	(EX. DMH) 13.20' (2) 12.52'	11.60'	
5	CBCI	+98.11, LT	15.58'	-	12.12'	
6	CBCI	+98.11, RT	15.58'	-	12.12'	
7	DMH	+02, 19' LT	15.70'	(EX. DMH) 12.11' (5) 12.11'	12.07'	
8	DMH	+18, 19' RT	15.71'	(EX DMH) UNKNOWN/TBD (6) 12.06'	11.57'	

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US3 (MYSTIC STREET) OVER MILL BROOK

CURBTIE, GRADING & DRAINAGE PLAN

SHEET 20 OF 25

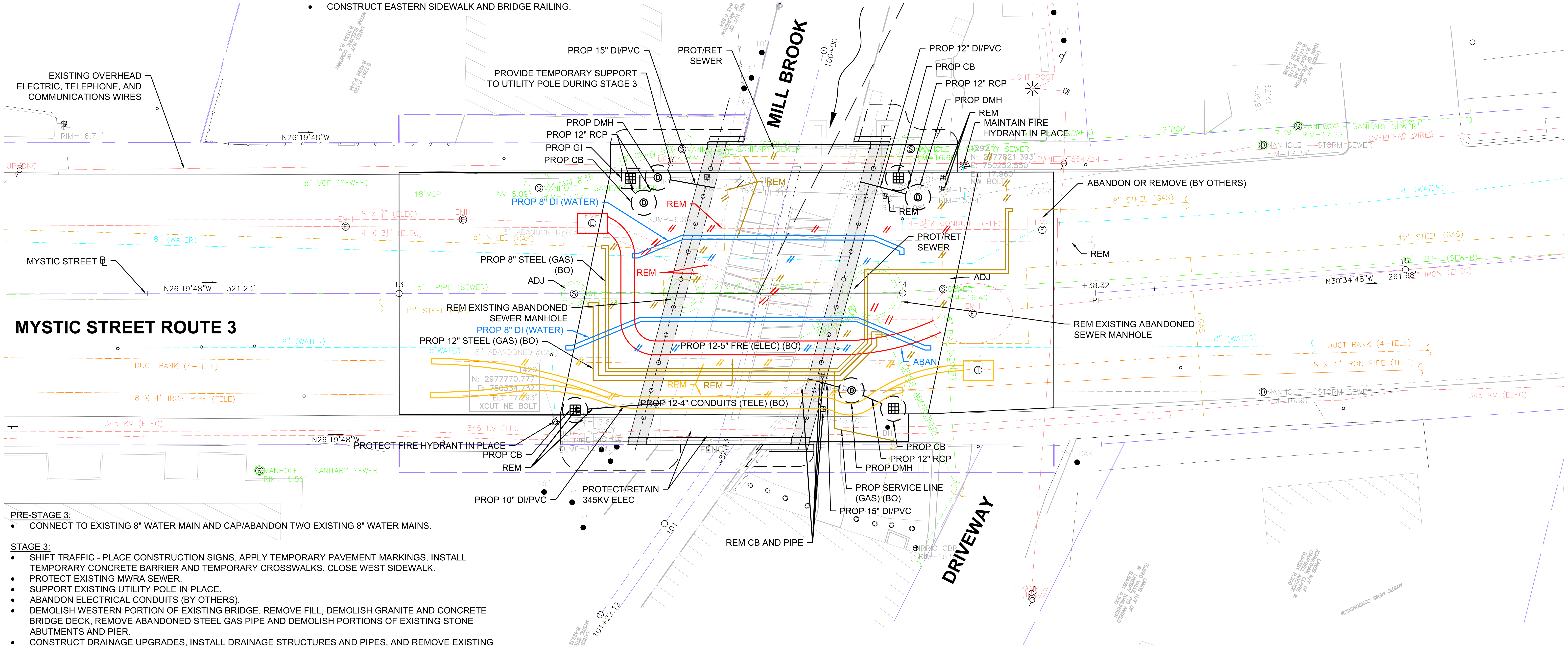
DESIGN PHASE:
- DESIGN TEMPORARY SUPPORT FOR EXISTING VERIZON DUCTBANKS (VERIZON).
- EVERSOURCE DESIGN TEMPORARY SUPPORT FOR EXISTING EVERSOURCE 345KV ELECTRIC LINES (EVERSOURCE).
- DESIGN PERMANENT RELOCATION AND PROVIDE APPLICABLE DETAILS (VERIZON, NGRID, EVERSOURCE, TOWN WATER)

PRE-STAGE 1:
- PLACE CONSTRUCTION SIGNING.
- REMOVE TREES AND CLEAR VEGETATION.
- INSTALL EROSION CONTROL FEATURES.
- PERFORM TEST PITS TO VERIFY LOCATIONS OF EXISTING UTILITIES AND INFRASTRUCTURE.
- CONFIRM CONSTRUCTABILITY OF PROPOSED LINES/FEATURES. COMPLETE ALL INITIAL/EARLY ACTION ITEMS

STAGE 1:
- SHIFT TRAFFIC - PLACE CONSTRUCTION SIGNS. APPLY TEMPORARY PAVEMENT MARKINGS. INSTALL TEMPORARY BARRIER AND TEMPORARY CROSSWALKS. CLOSE EAST SIDEWALK.
- DISMANTLE AND STACK EXISTING LANDSCAPE WALL AT 91 MYSTIC STREET.
- INSTALL TEMPORARY FILL RETENTION/EARTH SUPPORT.
- INSTALL TEMPORARY SUPPORT FOR EXISTING VERIZON DUCTBANKS (VERIZON)(BY OTHERS).
- INSTALL TEMPORARY SUPPORT FOR EXISTING EVERSOURCE 345KV ELECTRIC LINES (EVERSOURCE)(BY OTHERS).
- INSTALL TEMPORARY SUPPORT/PROTECT 12" GAS LINE AT NORTH ABUTMENT (NGRID)(BY OTHERS)
- PROTECT EXISTING 8" WATER MAIN.
- DEMOLISH EASTERN PORTION OF EXISTING BRIDGE. REMOVE FILL, DEMOLISH GRANITE AND CONCRETE BRIDGE DECK, REMOVE ABANDONED STEEL GAS PIPE AND DEMOLISH PORTIONS OF EXISTING STONE ABUTMENTS AND PIER.
- TEMPORARILY RELOCATE GAS SERVICE LINE TO 91 MYSTIC STREET.
- CONSTRUCT DRAINAGE UPGRADES, INSTALL DRAINAGE STRUCTURES AND PIPES, AND REMOVE EXISTING CATCH BASINS AND ASSOCIATED PIPING.
- INSTALL MICROPILES FOR EASTERN PORTION OF BRIDGE ABUTMENTS.
- INSTALL WATER CONTROL FOR PORTION OF ABUTMENT CONSTRUCTION.
- CONSTRUCT EASTERN PORTION OF BRIDGE ABUTMENTS.
- CONSTRUCT BRIDGE SEAT FOR EASTERN PORTION OF BRIDGE.
- ERECT STEEL BEAMS FOR EASTERN PORTION OF BRIDGE.
- TRANSFER EXISTING EVERSOURCE 345KV ELECTRIC LINES TO PERMANENT BRIDGE SUPPORTS. REMOVE TEMPORARY SUPPORT STRUCTURE (EVERSOURCE)(BY OTHERS).
- INSTALL PROPOSED VERIZON DUCTBANK ON PERMANENT BRIDGE SUPPORT. (VERIZON)(BY OTHERS)
- RELOCATE VERIZON LINES TO NEW CONDUITS/DUCTBANK. REMOVE EXISTING CONDUITS(VERIZON)(BY OTHERS).
- INSTALL NEW NATIONAL GRID 8" AND NATIONAL GRID 12" GAS ON PERMANENT BRIDGE SUPPORTS (NGRID)(BY OTHERS).
- INSTALL NEW EVERSOURCE DUCTBANK ON PERMANENT BRIDGE SUPPORTS (EVERSOURCE)(BY OTHERS).
- CONSTRUCT EASTERN PORTIONS OF THE BRIDGE DECK AND ABUTMENT DIAPHRAGMS.
- CONSTRUCT FULL DEPTH ROADWAY AND APPROACHES.
- CONSTRUCT EASTERN SIDEWALK AND BRIDGE RAILING.

PRE-STAGE 2:
- INSTALL PIPING TO CONNECT NEW NATIONAL GRID 8" AND 12" GAS PIPES ON THE BRIDGE TO EXISTING GAS LINES. INSTALL GAS SERVICE LINE CONNECTION TO 91 MYSTIC STREET. CAP/REMOVE EXISTING GAS PIPES (NGRID) (BY OTHERS)
- INSTALL DUCTBANKS TO CONNECT NEW EVERSOURCE DUCTBANK ON THE BRIDGE TO EXISTING MANHOLES(EVERSOURCE)(BY OTHERS).
- RELOCATE EVERSOURCE LINES TO NEW CONDUITS/DUCTBANK (EVERSOURCE)(BY OTHERS).

STAGE 2:
- SHIFT TRAFFIC - PLACE CONSTRUCTION SIGNS. APPLY TEMPORARY PAVEMENT MARKINGS. INSTALL TEMPORARY BARRIER. REMOVE TEMPORARY CROSSWALKS. OPEN EAST SIDEWALK.
- INSTALL TEMPORARY FILL RETENTION/EARTH SUPPORT.
- PROTECT SEWER SIPHON.
- CONTINUE TO PROTECT TWO EXISTING 8" WATER MAINS.
- DEMOLISH CENTER PORTION OF EXISTING BRIDGE. REMOVE FILL, DEMOLISH GRANITE AND CONCRETE BRIDGE DECK, REMOVE ABANDONED GAS PIPE AND ELECTRIC CONDUITS. DEMOLISH PORTIONS OF EXISTING STONE ABUTMENTS AND PIER.
- INSTALL MICROPILES FOR CENTER PORTION OF BRIDGE ABUTMENTS.
- INSTALL WATER CONTROL FOR PORTION OF ABUTMENT CONSTRUCTION.
- CONSTRUCT CENTER PORTION OF BRIDGE ABUTMENTS.
- CONSTRUCT BRIDGE SEAT FOR CENTER PORTION OF BRIDGE.
- ERECT STEEL BEAMS FOR CENTER PORTION OF BRIDGE.
- INSTALL PROPOSED 8" WATER MAIN ON PERMANENT BRIDGE SUPPORT.
- CONSTRUCT CENTER PORTIONS OF THE BRIDGE DECK AND ABUTMENT DIAPHRAGMS.
- CONSTRUCT FULL DEPTH ROADWAY AND APPROACHES.



PRE-STAGE 3:
- CONNECT TO EXISTING 8" WATER MAIN AND CAP/ABANDON TWO EXISTING 8" WATER MAINS.

STAGE 3:
- SHIFT TRAFFIC - PLACE CONSTRUCTION SIGNS. APPLY TEMPORARY PAVEMENT MARKINGS. INSTALL TEMPORARY CONCRETE BARRIER AND TEMPORARY CROSSWALKS. CLOSE WEST SIDEWALK.
- PROTECT EXISTING MWRA SEWER.
- SUPPORT EXISTING UTILITY POLE IN PLACE.
- ABANDON ELECTRICAL CONDUITS (BY OTHERS).
- DEMOLISH WESTERN PORTION OF EXISTING BRIDGE. REMOVE FILL, DEMOLISH GRANITE AND CONCRETE BRIDGE DECK, REMOVE ABANDONED STEEL GAS PIPE AND DEMOLISH PORTIONS OF EXISTING STONE ABUTMENTS AND PIER.
- CONSTRUCT DRAINAGE UPGRADES, INSTALL DRAINAGE STRUCTURES AND PIPES, AND REMOVE EXISTING CATCH BASINS AND ASSOCIATED PIPING.
- INSTALL MICROPILES FOR WESTERN PORTION OF BRIDGE ABUTMENTS.
- INSTALL WATER CONTROL FOR PORTION OF ABUTMENT CONSTRUCTION.
- CONSTRUCT WESTERN PORTION OF BRIDGE ABUTMENTS.
- CONSTRUCT BRIDGE SEAT FOR WESTERN PORTION OF BRIDGE.
- ERECT STEEL BEAMS FOR WESTERN PORTION OF BRIDGE.
- INSTALL PROPOSED 8" WATER MAIN ON PERMANENT BRIDGE SUPPORT.
- CONSTRUCT WESTERN PORTIONS OF THE BRIDGE DECK AND ABUTMENT DIAPHRAGMS.
- CONSTRUCT FULL DEPTH ROADWAY AND APPROACHES.
- CONSTRUCT WESTERN SIDEWALK AND BRIDGE RAILING.

UTILITY PLAN
SCALE: 1" = 10'

POST STAGE 3:
- ADJUST DRAINAGE AND SEWER STRUCTURES TO FINAL GRADE.
- ADJUST ELECTRIC STRUCTURES TO FINAL GRADE. (EVERSOURCE) (BY OTHERS)
- ADJUST TELEPHONE STRUCTURES TO FINAL GRADE. (VERIZON) (BY OTHERS)
- ROADWAY MILLING, PAVING, PAVEMENT MARKINGS.
- LOAM AND SEED. RECONSTRUCT RETAINING WALL.
- FINAL CLEAN UP
- REMOVE TEMPORARY CONCRETE BARRIER, TEMPORARY CROSSWALKS, AND CONSTRUCTION SIGNING.

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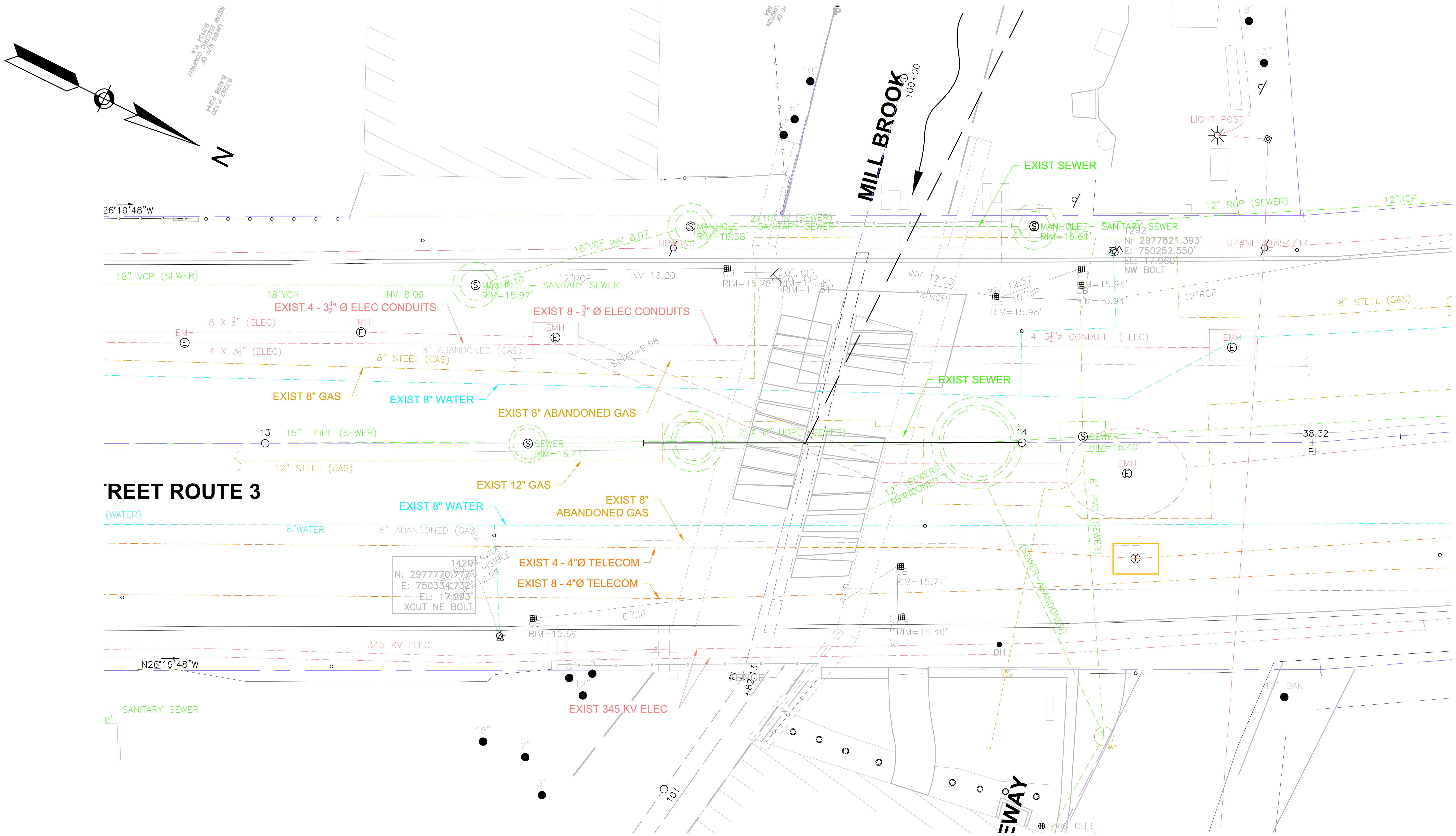
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

UTILITY PLAN

SHEET 21 OF 25



EXISTING UTILITY PLAN
SCALE: 1" = 8'

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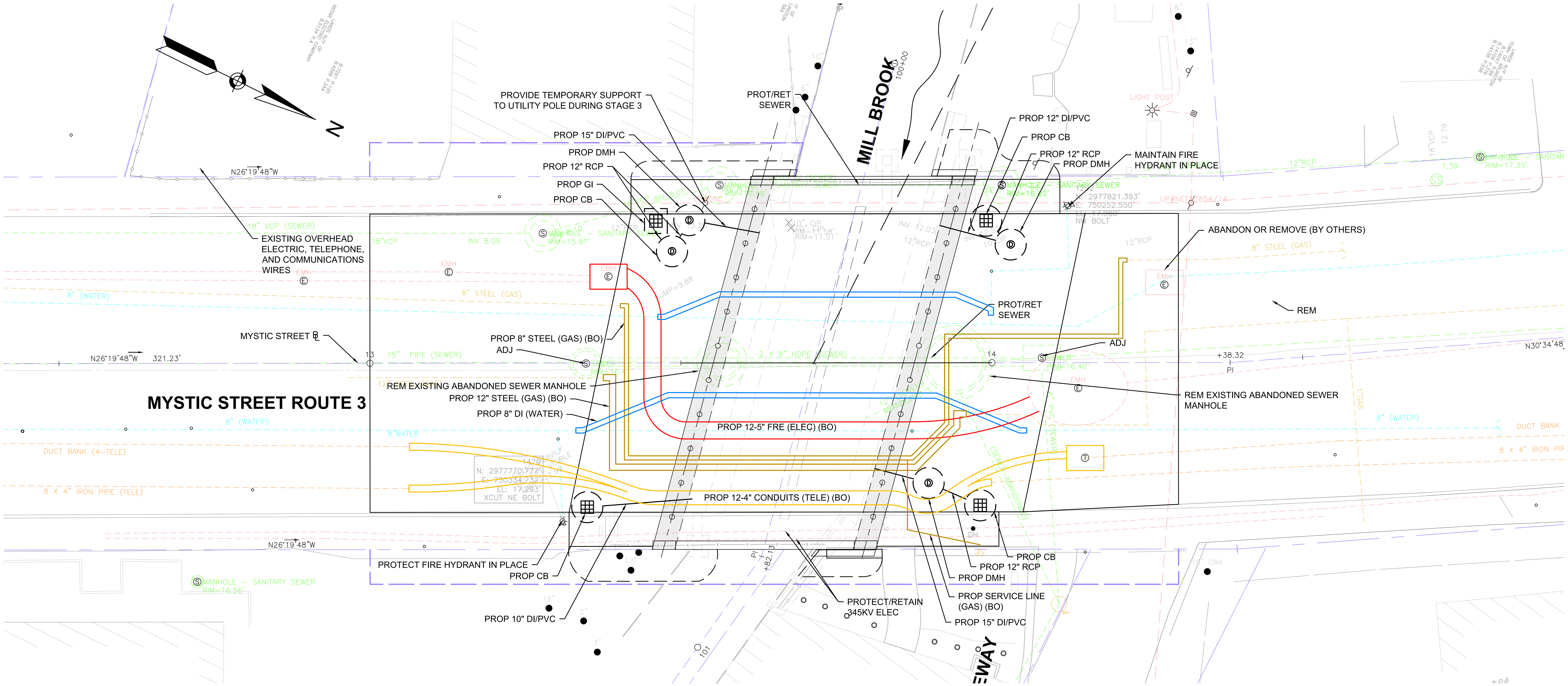
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

EXISTING UTILITY PLAN

SHEET 22 OF 25



PROPOSED UTILITY PLAN

SCALE: 1" = 8'

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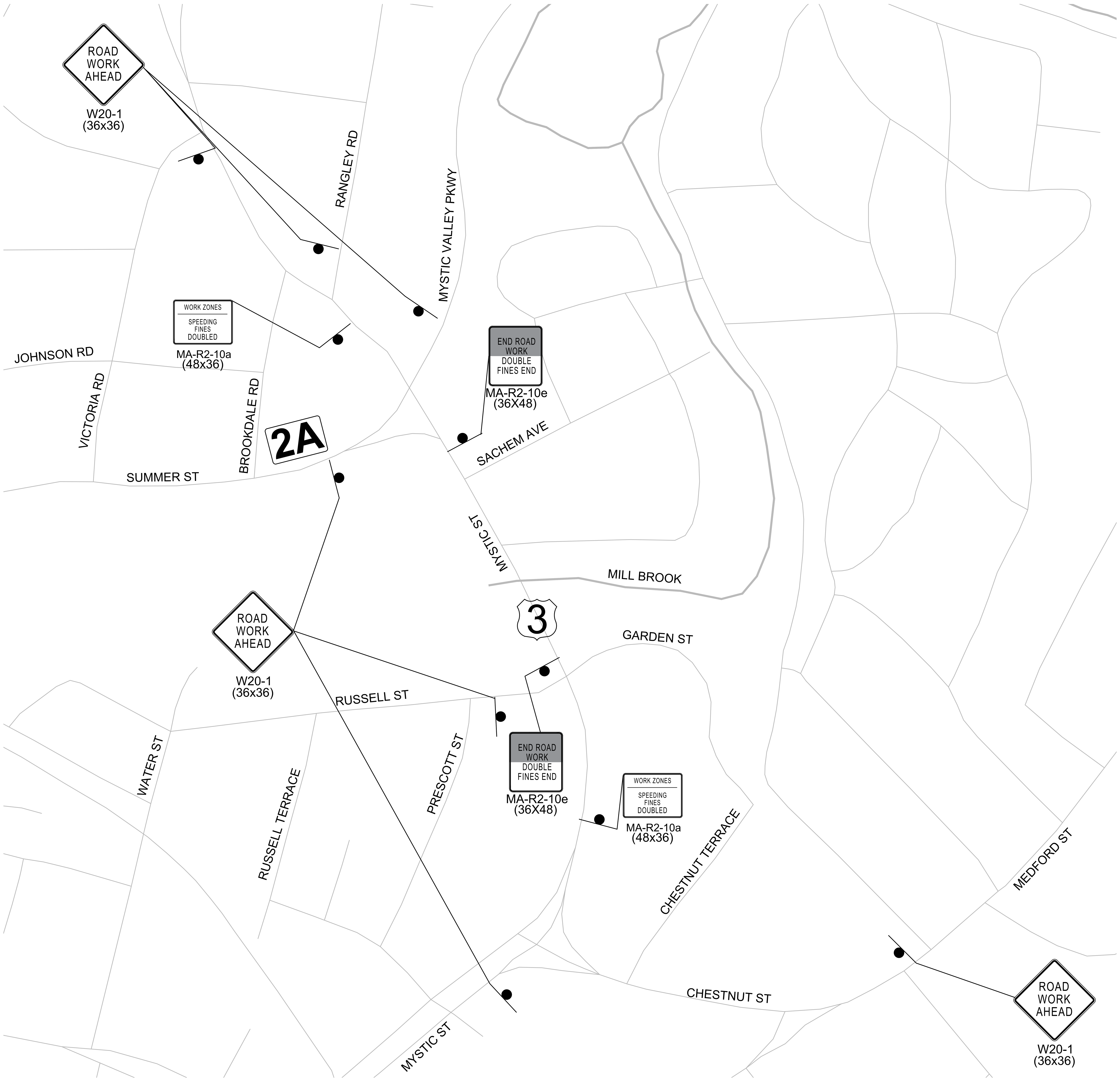
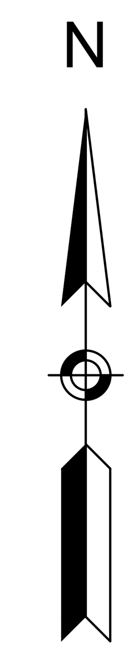
PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

PROPOSED UTILITY PLAN

SHEET 23 OF 25





ADVANCE SIGNING PLAN

NOTES:

1. ALL TEMPORARY TRAFFIC CONTROL WORK SHALL CONFORM TO THE LATEST EDITION OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD) AND ALL REVISIONS, UNLESS SUPERCEDED BY THESE PLANS.
2. ALL SIGN LEGENDS, BORDERS, AND MOUNTING SHALL BE IN ACCORDANCE WITH THE MUTCD.
3. TEMPORARY CONSTRUCTION SIGNING AND ALL OTHER TRAFFIC CONTROL DEVICES SHALL BE IN PLACE PRIOR TO THE START OF ANY WORK.
4. TEMPORARY CONSTRUCTION SIGNING, BARRICADES, AND ALL OTHER NECESSARY WORK ZONE TRAFFIC CONTROL DEVICES SHALL BE REMOVED FROM THE HIGHWAY OR COVERED WHEN THEY ARE NOT REQUIRED FOR CONTROL OF TRAFFIC.
5. SIGNS AND SIGN SUPPORTS LOCATED ON OR NEAR THE TRAVELED WAY, CHANNELIZING DEVICES, BARRIERS, AND CRASH ATTENUATORS MUST PASS THE CRITERIA SET FORTH IN NCHRP REPORT 350, "RECOMMENDED PROCEDURES FOR THE SAFETY PERFORMANCE EVALUATION OF HIGHWAY FEATURES" AND/OR "MANUAL FOR ASSESSING SAFETY HARDWARE" (MASH).
6. CONTRACTORS SHALL NOTIFY EACH ABUTTER AT LEAST 24 HOURS IN ADVANCE OF THE START OF ANY WORK THAT WILL REQUIRE THE TEMPORARY CLOSURE OF ACCESS, SUCH AS CONDUIT INSTALLATION, EXISTING PAVEMENT EXCAVATION, TEMPORARY DRIVEWAY PAVEMENT PLACEMENT, AND SIMILAR OPERATIONS.
7. THE FIRST FIVE PLASTIC DRUMS OF A TAPER SHALL BE MOUNTED WITH TYPE A LIGHTS.
8. THE ADVISORY SPEED LIMIT, IF REQUIRED, SHALL BE DETERMINED BY THE ENGINEER.
9. DISTANCES ARE A GUIDE AND MAY BE ADJUSTED IN THE FIELD BY THE ENGINEER.
10. MAXIMUM SPACING OF TRAFFIC DEVICES IN A TAPER (DRUMS OR CONES) IS EQUAL IN FEET TO THE SPEED LIMIT IN MPH.
11. MINIMUM LANE WIDTH IS TO BE 11 FEET (3.3m) UNLESS OTHERWISE SHOWN. MINIMUM LANE WIDTH TO BE MEASURED FROM THE EDGE OF DRUMS OR MEDIAN BARRIER.
12. ALL SIGNS SHALL BE MOUNTED ON THEIR OWN STANDARD SIGN SUPPORTS.

LEGEND:

- ● DRUM OR CONE @ 15' O.C. (TYP)
- ➡ DIRECTION OF TRAFFIC
- SIGN
- TYPE III BARRICADE

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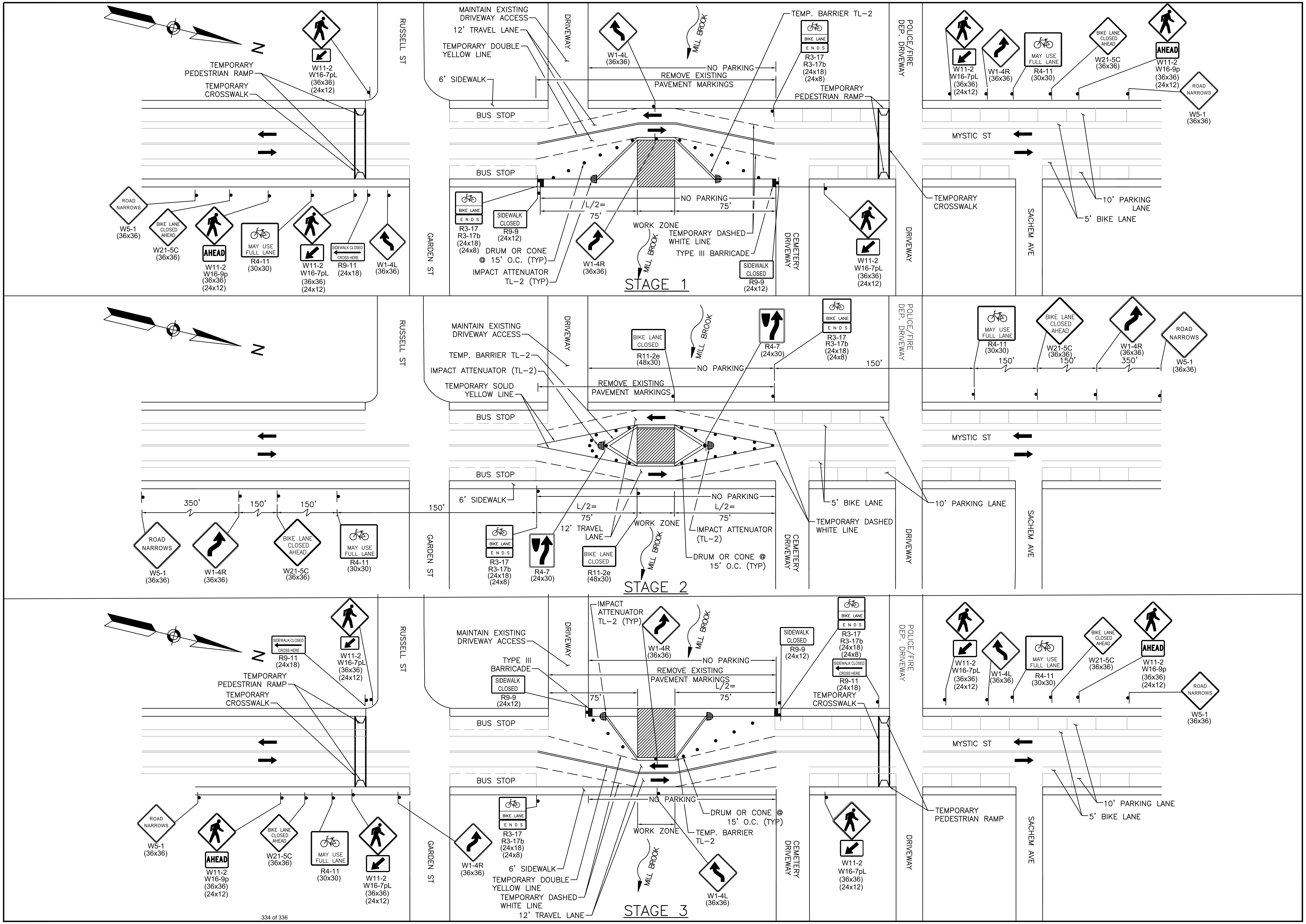
TOWN OF ARLINGTON

PROPOSED BRIDGE REPLACEMENT
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

ADVANCE WARNING SIGN PLAN

SHEET 24 OF 25



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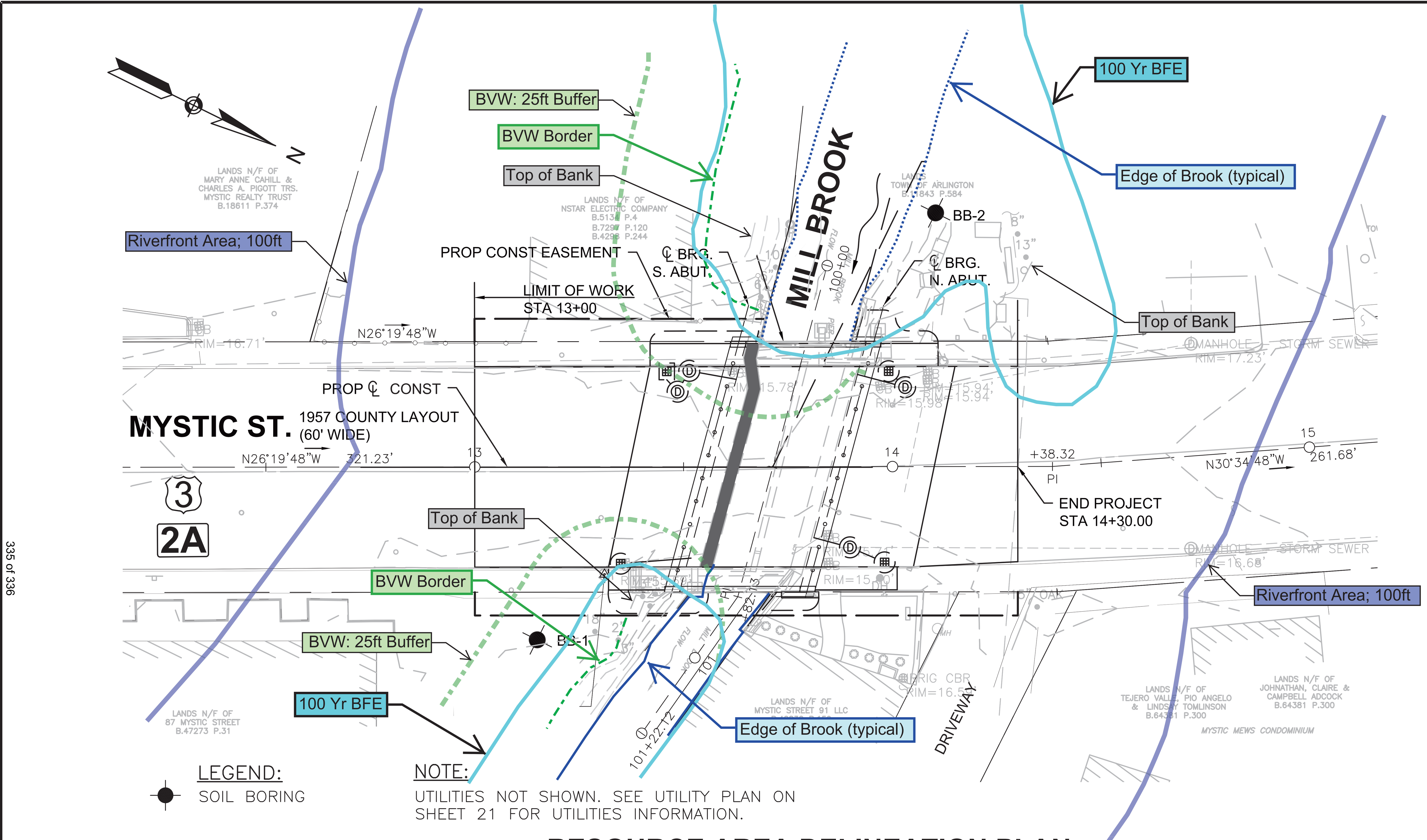
A-10-015 (C10)
US3 (MYSTIC STREET) OVER MILL BROOK

TEMPORARY TRAFFIC CONTROL PLAN

SHEET 25 OF 25



LEGEND:

SOIL BORING

NOTE:

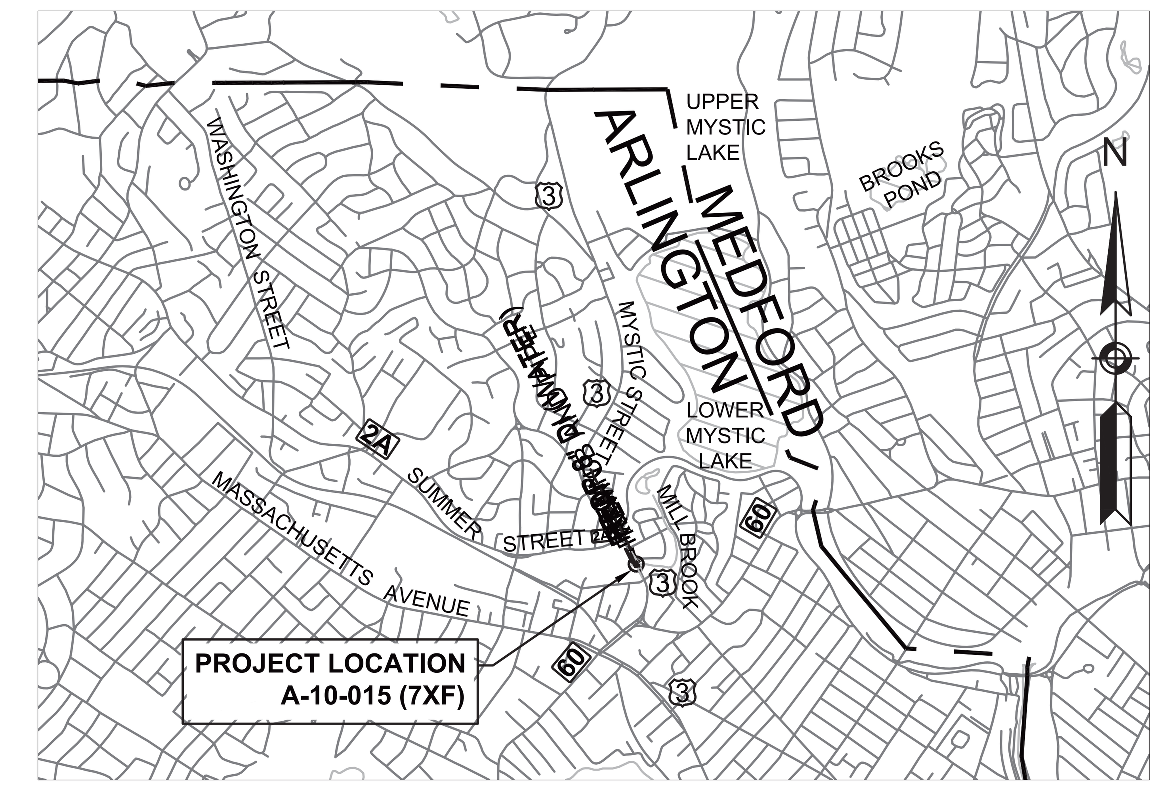
UTILITIES NOT SHOWN. SEE UTILITY PLAN ON SHEET 21 FOR UTILITIES INFORMATION.

RESOURCE AREA DELINEATION PLAN

Scale: 1" = 20'

RESOURCE AREA SUMMARY

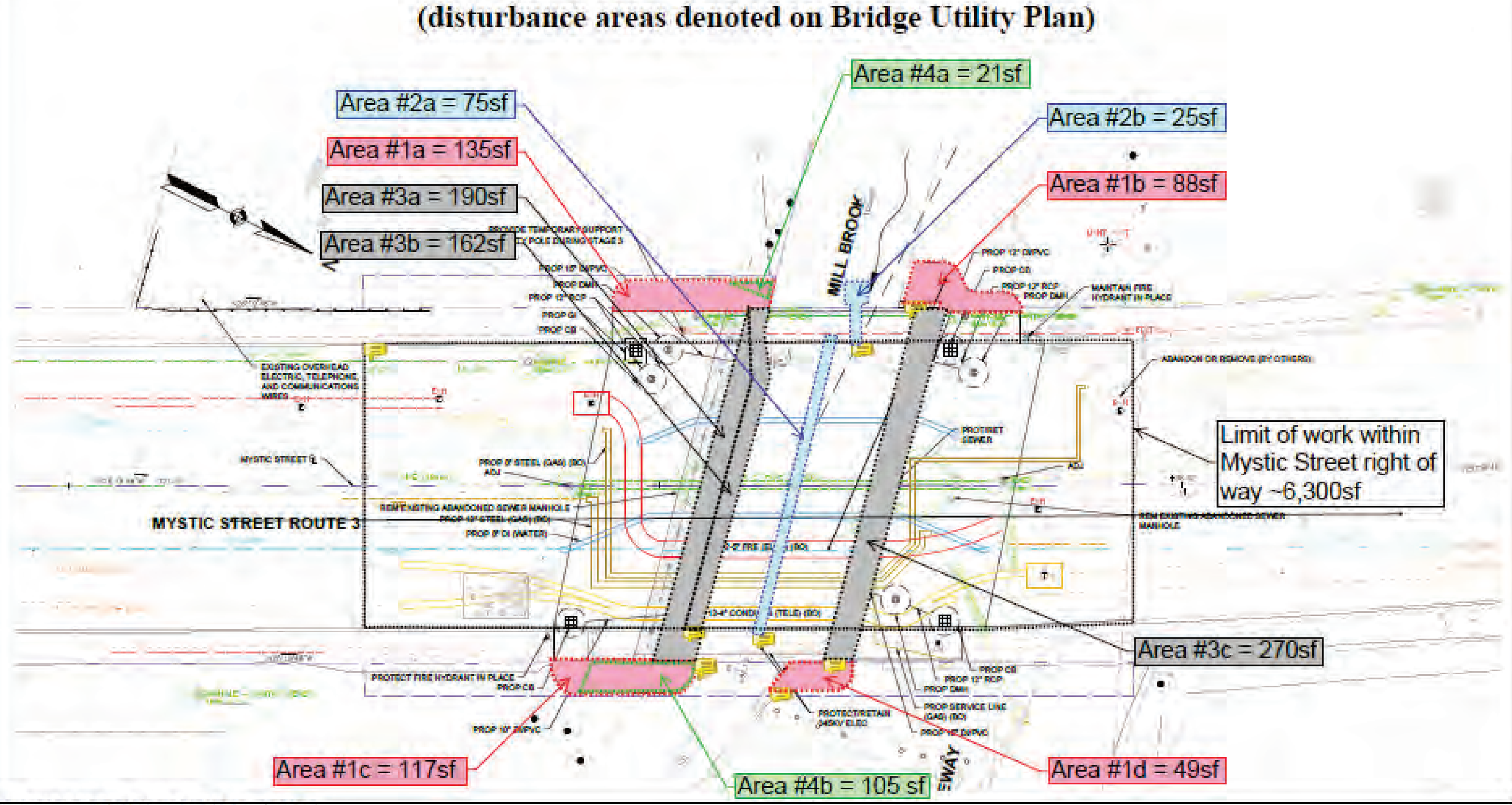
Description	Disturbance
Land Under Water:	100sf (temporary)
BVW Buffer Zone:	125sf (temporary)
Bank Area:	389 sf (temporary)
Flood Zone: AE	22 sf (temporary)



LOCUS

SCALE: 1" = 2000'

WORK WITHIN RESOURCE AREA PLAN
(disturbance areas denoted on Bridge Utility Plan)



WORK IN RESOURCE AREA

Area #1: work within the riverfront area and wetland buffer zone = 389sf; work in this area consists of excavation to install wing walls of abutments and restoration of disturbed area with wetland restoration mix and/or rip-rap.

Area #2: work under water = 100sf; work shall consists of removing existing center piers. Piers and footing to be lifted with grapple and/or chains to minimize disturbance. Excavation method will not be utilized.

Area #3: work within the wetland and river front buffer area = 622sf; work in this area will not cause additional disturbance. Area on top of existing abutments will be capped with concrete top and area behind caps filled with rip-rap.

Area #4: work within a BVW = 126sf (inclusive to Area #1)

CONSERVATION COMMISSION CONDITIONS LIST

CONSERVATION COMMISSION CONDITIONS LIST

PRE-CONSTRUCTPOMION

1. Work permitted by this Order and Permit shall conform to the Notice of Intent, the approved plans and documents (listed above), and oral representations (as recorded in hearing minutes) submitted or made by the Applicant and the Applicant's agents or representatives, as well as any plans and other data, information or representations submitted per these Conditions and approved by the Commission.
2. The provisions of this Order and Permit shall apply to and be binding upon the Applicant and Applicant's assignees, tenants, property management company, employees, contractors, and agents.
3. If there are conflicting conditions within this Order, the stricter condition(s) shall govern.
4. No work shall begin under this Order until: (a) all other required permits or approvals have been obtained and (b) the appeal period of ten (10) business days from the date of issue of this Order has expired without any appeal being filed, and (c) this Order has been recorded in the Registry of Deeds. No work shall be started under this Permit until all other necessary permits or approvals have been obtained.
5. The Applicant shall ensure that a copy of this Order of Conditions and Permit for work, with any referenced plans, is always available on site, and that contractors, site managers, foremen, and sub-contractors understand its provisions.
6. Prior to starting work, the Applicant shall submit to the Commission the names and 24-hour phone numbers of project managers or the persons responsible for site work or mitigation.
7. Before work begins, erosion and sediment controls shall be installed at the limits of the work area or as outlined on the approved plans. These will include a silt fence and a biodegradable 12-inch straw or silt wattle around the entire work area (hay bales are not allowed and silt socks are preferred).
8. Prior to any work commencing, a sign no less than 2 square feet or more than 3 square feet, visible from the street, shall be displayed reading "MA DEP File # _____" and not placed on a living tree.
9. The Applicant shall complete the proposed work during low flow conditions only.
10. The contractor shall contact Conservation Agent; concomm@town.arlington.ma.us;or (781-316-3012) to arrange for a pre-construction meeting with the on-site project manager to walk through the Order of Conditions, confirm the wash out location, and walk the site to confirm the installation and placement of erosion controls prior to the start of any grading or construction work.
11. The contractor shall provide written Notice of the commencement of work start date to the Conservation Agent 48 hours prior to start of work.
12. The Commission, its employees, and its agents shall have the right of entry onto the site to inspect for compliance with the terms of this Order of Conditions and Permit until a Certificate of Compliance has been issued.
13. Any backfill or reuse of on-site materials shall be free of contamination in accordance with the Massachusetts Contingency Plan, 310 CMR 40.0000. All fill used in connection with this project shall be clean borrow. The following shall be prohibited: chemically contaminated material; concrete and asphalt rubble; crushed glass; stumps and other solid waste or anthropogenic materials.

POST-CONSTRUCTION

14. When requesting a Certificate of Compliance for this Order of Conditions, the Applicant must submit a written statement from a Massachusetts professional engineer, registered land surveyor, or registered landscape architect certifying that the completed work complies with the plans referenced in this Order or provide an as-built plan and statement describing any differences.

DUMPSTERS

15. All dumpsters must be covered at the end of each workday, and no dumpsters will be allowed overnight within the 100-foot Buffer Zone or Adjacent Upland Resource Areas ("AURA") or other Resource Areas.

STOCKPILING

16. No uncovered stockpiling of materials shall be permitted overnight within 100 feet of any waterway or water body. Stockpiling shall occur only where noted on approved plans.

EROSION

17. Areas that are disturbed by construction and access activities shall as soon as possible be brought to final grade and reseeded and restabilized and shall be done so prior to the removal of the erosion control barrier. Erosion control measures shall be installed per the approved plans.

EQUIPMENT

18. The Commission and its Agent shall have the discretion to require additional erosion/siltation control methods during construction if necessary.
19. No heavy equipment may be stored overnight within 50 feet of the wetland and no refueling or maintenance of machinery shall be allowed within the 100-foot Buffer Zone, 200-foot Resource Area, and Adjacent Upland Resource Area or within any Resource Area.
20. Construction entrances shall be used and maintained only where noted on approved plans.
21. Arrangements shall be made for any rinsing of tools, equipment, etc. associated with on -site mixing or use of concrete or other materials such that the wastewater is disposed of in the concrete wash out station-at least 50 feet from the resource area. In no case may waste water be discharged into or onto Resource Areas on or adjacent to the site. In no case may waste water be placed in storm drains. Any spillage of materials shall be cleaned up promptly.

SWEEPING

22. Any dirt or debris spilled or tracked onto any paved streets shall be swept up and removed daily.
23. The areas of construction shall remain in a stable condition at the close of each construction day.

DEWATERING

24. Any dewatering operations shall conform to the following:
    (a) Notify the Conservation Commission that dewatering is required.
    (b) Any catch basins, drains, and outfalls to be used in dewatering operations shall be cleaned out before operations begin.
    (c) Any water discharged as part of any dewatering operation shall be passed through filters, on-site settling basins, settling tank trucks, or other devices to ensure that no observable sediments or pollutants are carried into any Resource Area, street, drain, or adjacent property.
    (d) Measures shall be taken to ensure that no erosion or scouring shall occur on public or private property, or on the banks or bottoms of water bodies, because of dewatering operations.
    (e) Dewatering shall occur only where noted on approved plans.

PLANTINGS

25. Prior to plant installation, the Applicant shall submit planting plan details to the Conservation Commission for approval. Planting details shall include plant sizes, Latin names, regular names, number of plants, and transported method (containerized, balled-and-burlapped, etc.). All plantings shall be native and be installed and maintained according to the standards of the American Association of Nurserymen (AAN). **This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.**
26. The Applicant shall protect all area trees per the Town Wetlands Protection Regulations, Section 24 Vegetation Removal and Replacement, protecting trees through securing (not nailing) 2x4 boards, between 6-8 feet in length, around tree base. The boards shall be installed vertically such that one end is installed directly into the ground. Alternative protection measures must be approved by the Commission or its agent.
27. The Applicant shall replace all removed trees per the Town Wetlands Protection Regulations. Section 24 Vegetation Removal and Replacement.
28. All native restoration plantings shall be maintained for three years, and invasive species removal implemented through this project shall be ongoing for three years. A survival rate of at least 80% must be maintained for the approved restoration plantings. A monitoring report shall be submitted annually in November for the three-year monitoring period and shall include the number and types of restoration plantings evaluated, condition of the plantings, and status of invasive plant removal. The Applicant must provide a monitoring report by a qualified consultant for survival of all approved plantings. The monitoring report must include measures to remove invasive species if they are discovered.

CHEMICALS

29. To avoid adding excess nitrogen runoff, the Applicant shall only treat the lawn area with slow-release nitrogen fertilizer. Application of lawn fertilizer cannot occur in the summer, or after storm events. Lawn fertilizer shall only be applied twice a year, in spring and fall. **This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.**
30. New plantings shall only be fertilized once, during the initial planting year. No pesticides or rodenticides shall be used to treat pest management issues. **This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.**
31. Only the herbicides and herbicide treatment methods stated within the NOI are approved to treat invasive plants. No other herbicides or treatment methods are approved. This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.

PERVIOUS SURFACES

32. Pervious surfaces shown on the project plans shall be maintained and not be replaced by impervious surfaces. This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.
33. Installed permeable surfaces shall be maintained in perpetuity. Prior to construction, the Applicant shall provide an operations and maintenance plan for installed permeable surfaces and, at the discretion of the Commission, a signed copy of a contract for professional maintenance. This shall be a continuing condition that survives the expiration of the permit and shall be included in any Certificate of Compliance as a continuing condition.

STORMWATER

34. The Applicant shall protect all adjacent catch basins using silt socks.
35. The Applicant shall conduct catch basin sump cleanings as necessary to proximate catch basins at the end of the project work period.
36. The project shall not cause an increase in run-off or stormwater volume onto adjacent properties, either during construction or when completed.

DATE	DRW. BY	CALC. BY	APPRV. BY	DESCRIPTION
04/01/2021	ABL	ABL	AMS	CHAPTER 85 SUBMISSION

REGISTERED PROFESSIONAL ENGINEER

DATE

TOWN OF ARLINGTON MASSACHUSETTS

RESOURCE AREA PLAN

Town of Arlington, Massachusetts

Request for Determination of Applicability: 106-108 Varnum Street

Summary:
Request for Determination of Applicability: 106-108 Varnum Street

This public hearing will consider a Request for Determination of Applicability to pave a parking area in the rear of 106-108 Varnum Street within Bordering Land Subject to Flooding (Zone AE).